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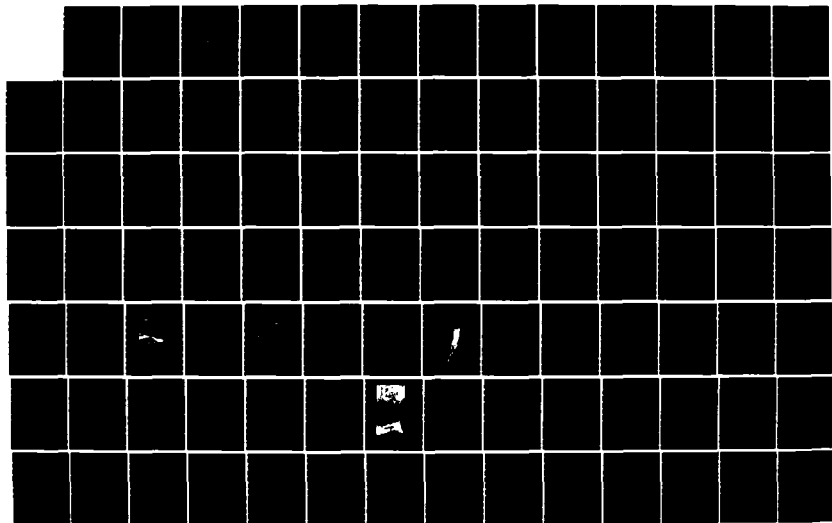
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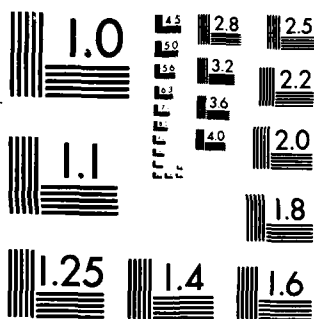
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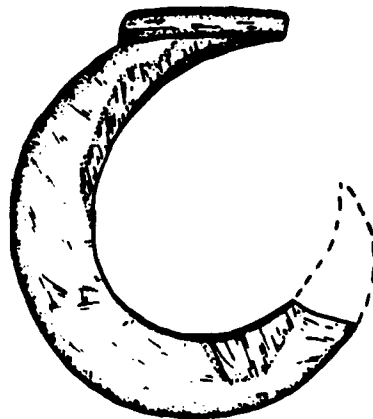


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ARCHAEOLOGICAL STUDY OF  
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<p>CA-VEN-110 is a coastal Chumash site bordering Mugu Lagoon in Ventura County, an area known as an important prehistoric and protohistoric provincial capitol. The field test was designed to evaluate its integrity and scientific research potential.</p> <p>(continued)</p>			



20. (continued)

The shell midden proved considerably thicker than predicted, buried below thick sediments. The deposit was unusually rich in faunal remains. Four features were recorded and two burials, bringing the total known interments to nine. Five radiocarbon dates are stratigraphically consistent between 1230 and 960 years BP, with continuing occupation into the early historical period demonstrated by Late shell and a few glass beads. Although the primary site function seems related to subsistence, other activities represented include lithic maintenance and beadmaking.

Evidence from radiocarbon, palynology, geomorphology, bead typology, and internal stratigraphy confirms that the midden is an intact primary deposit. Data recovered confirm that CA-VEN-110 has potential to contribute valuable information toward the solution of important scientific research problems at the regional level. The assessment supports the 1975 finding that the site is eligible to the National Register of Historic Places. Preservation is recommended, with mitigation by data recovery and further analysis needed if total conservation is not possible.

ARCHAEOLOGICAL STUDY OF  
CA-VEN-110,  
VENTURA, CALIFORNIA

Prepared for:

Los Angeles District, Corps of Engineers  
300 North Los Angeles Street  
Los Angeles, California 90053

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Gwendolyn R. Romani

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## ABSTRACT

At the request of the Corps of Engineers, Los Angeles District, Greenwood and Associates has conducted a field test and limited analysis of cultural materials present at CA-VEN-110, at Calleguas Creek bordering Mugu Lagoon in Ventura County, California. The investigation was designed to determine whether the site still meets the criteria under which it had been listed on the National Register of Historic Places, or more explicitly, if it has retained its integrity and if it contains the categories and quantities of data needed to address significant research questions.

The field work comprised 19 mechanically dug test trenches and seven units (4.83 cubic meters) of controlled hand excavation. The deposit proved to be considerably deeper and thicker than predicted, and unusually rich in faunal remains of all kinds. Four features were encountered and two burials, bringing the total number of documented interments to nine. Five radiocarbon dates range between 1230 and 960 years B.P., with continuing occupation into the early historical period interpreted from glass beads and certain Late shell bead types. Although the primary function of the site seems related to subsistence, other activities inferred from the spatial and quantitative analysis include lithic maintenance and beadmaking.

Evidence from radiocarbon dating, palynological samples, burials, bead types, geomorphology, and internal stratigraphy supports the conclusion that the midden is an intact, primary deposit. The data already recovered provide evidence that CA-VEN-110 has the potential to contribute valuable information toward the solution of significant scientific research problems at the regional level. Since these two essential National Register criteria are met, recommendations are offered for preservation or, if this is not possible, for mitigation by means of data recovery.

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The study has benefited greatly from the assistance and cooperation of the Candelaria American Indian Council and representatives of the Ventureño Chumash. We acknowledge with pleasure the participation of Rita Valenzuela, Anna Tinoco, and Edward Valenzuela, and the several visits by Melissa Parra and others.

Drs. Charles Rozaire, Camm Swift, and James McClean of Los Angeles County Museum of Natural History identified various specimens and provided additional insights and good advice.

And finally, the recognition that without the outstanding efforts of all the dedicated crew named herein, who contended with mud, water, and noxious effluents, none of this report would have been possible.

R.S.G.

J.M.F.

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## 1. INTRODUCTION

### Purpose and Objectives

The archaeological site designated as CA-VEN-110 has been undergoing a variety of impacts for many years causing disturbance, displacement, and actual loss of cultural materials for perhaps a century. The agents responsible include both natural and man-made forces. Since the site is listed in the National Register of Historic Places (NRHP), the Los Angeles District, Corps of Engineers, has need to know whether the archaeological resource still retains: (a) its integrity; (b) potential scientific research value; and (c) continuing concern on the part of the local Native American people for the cultural and religious values contained. If these conditions are no longer met, the site would no longer be considered eligible for the NRHP. If the earlier determination of significance is sustained, and preservation cannot be assured, additional efforts may be found necessary to mitigate any further impacts upon the scientific and cultural values demonstrated. Mandates for management are set forth in the provisions of the National Historic Preservation Act; 33 CFR 325 and Appendix C; 36 CFR 800; and the existing Memorandum of Agreement.

As provided in the contract between the Los Angeles District, Corps of Engineers, and Greenwood and Associates, the field investigation described in this report was preceded by completion of a Research Design which is included as Appendix 9. Details of the environmental and cultural background are provided in that document and incorporated herein by reference. The level of effort is that of a limited test excavation for the explicit purposes of evaluating the present integrity and scientific research potential of CA-VEN-110. It was recognized under the contract obligation and Research Design that not every avenue of analysis could or would be pursued at this time. Instead, the focus of the approach would be to assess to what degree intact



materials are present which would lend themselves to the more intense studies needed to address the research questions posed, or others which would become apparent during the testing process.

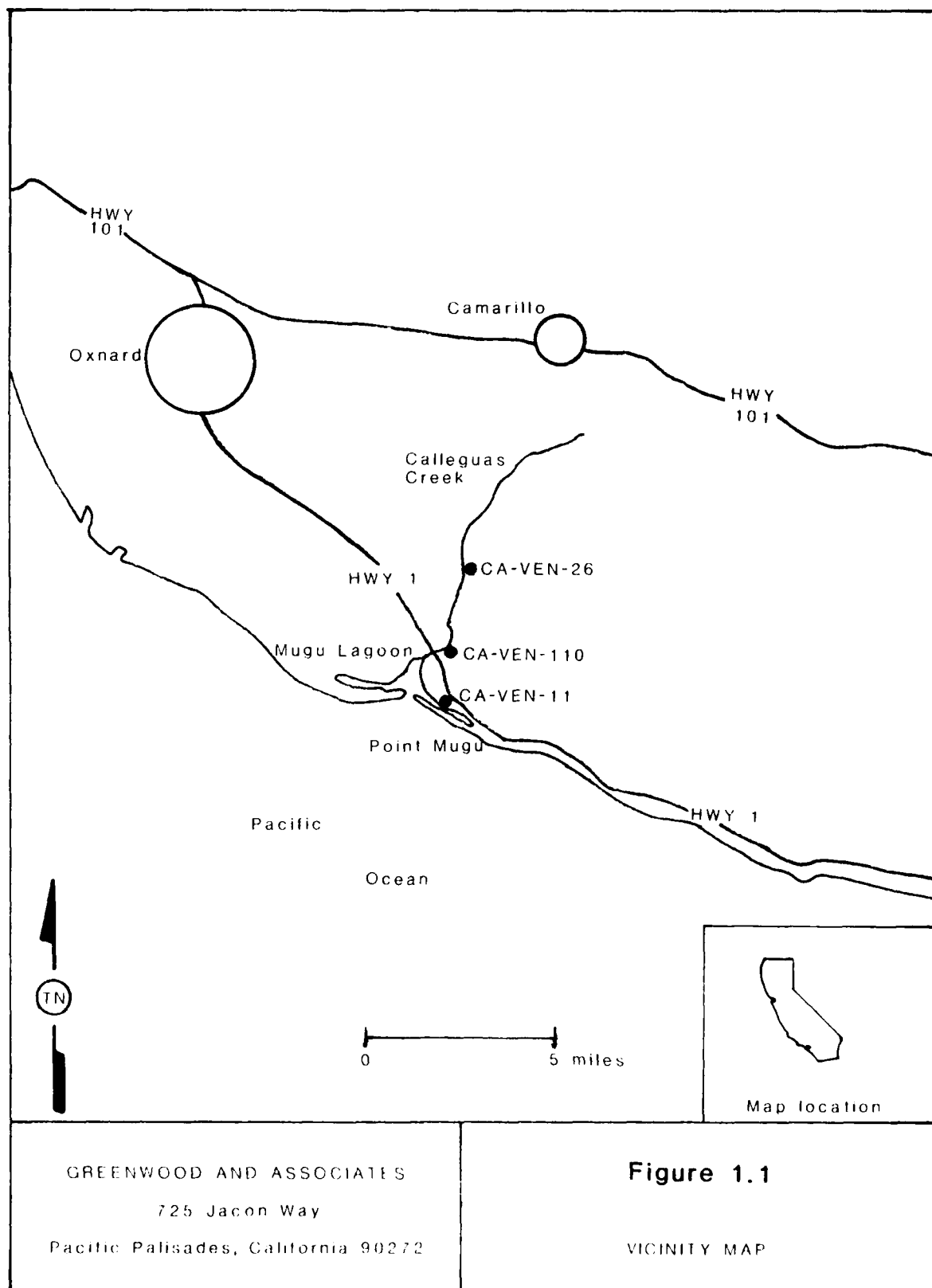
The investigation was conducted with the full cooperation of the Ventureño Chumash of Ventura County and Candelaria American Indian Council. Policies regarding the employment of a working monitor, treatment of human remains, and curation of artifacts were established in advance, and the Research Design was submitted for approval. One or more designated representatives participated in the field work throughout the excavation and monitored the analysis of human remains.

#### Environmental Setting

CA-VEN-110 is situated in the southeastern edge of the Oxnard Plain (Figure 1.1), near the southwest corner of Ventura County, California.

...the deltaic-like Oxnard Plain was extended seaward by large quantities of sediment provided by the Ventura and Santa Clara Rivers. The sediment may have been swept eastward by long-shore currents, as happen today, forming a large embayment between the mouth of the Santa Clara River and the Santa Monica Mountains. This embayment might have then gradually filled to become the Mugu Lagoon of historic times (Warne 1966:43).

The lowering of sea levels beginning near the end of the Middle Pleistocene, together with the growth of a barrier beach along an area of subsidence, resulted in the ultimate configuration of the lagoon about 3000 years ago (Steffen 1982:14, 49). Since then, the area of tidal inundation has been reduced from about 2000 acres to approximately 700 acres, primarily as a result of natural sedimentation and modern land filling (Ibid.:51-52, Figure 16).



The site lies within the current channel of Calleguas Creek, once an intermittent stream which, with Revolon Slough, drained the Simi and Conejo Valleys and emptied onto the Oxnard Plain somewhere between Somis and above Mugu Lagoon. The history of this channel is relevant to the present condition of the site. As agriculture increased in the 1860s and expanded to the eastern areas of the Oxnard Plain, local farmers were affected by repeated flooding from the Calleguas drainage. Beginning about 1884, residents began to clear a straight channel from the present alignment of Highway 101 to the Conejo Creek junction. A leveed channel from Conejo Creek and Lewis Road was constructed about 1923. In 1924, Revolon Slough was dug to provide drainage, and 4000 feet of levees were built from near Lewis Road to the crossing at Hueneme Road. Lower Calleguas Creek was channelized in 1926, and in 1931 levees were built to the Coast Highway (Hausner 1975; Steffen 1982).

Material to build the levees was obtained from agricultural ditches and later from sediments removed from the Calleguas channel. The splitter levee which separates Calleguas Creek from Revolon Slough was built in the 1950s from creek bed materials; it has since been raised and shifted. More fill removed from Calleguas Creek was used to expand the runway on the U. S. Naval Reservation in 1953-1954, for construction of Edison's Ormond Beach generating plant in 1968, and further filling at Pt. Mugu in 1969. Construction for the Revolon Slough and Beardsley Wash watersheds was authorized in 1966, and at least two sediment removal operations have followed. For additional detail, see Appendix 9.

The combined effects of channelization, repeated removals of sediment, and natural processes of erosion have modified the landscape suggested by early historical maps, and changes in the environment have almost certainly resulted in shifts in the plant and animal species once available to prehistoric populations. The most dramatic changes would have occurred after the site was

abandoned; the modifications would thus affect the present integrity of the remains more than they would have contributed to changes in the subsistence pattern or other adaptations of the people who once lived at CA-VEN-110. Descriptions and lists of the soils, plants, and animals now present at Mugu Lagoon and species which have been identified at other archaeological sites of the immediate vicinity are included in the Research Design (Appendix 9). In summary, the faunal and floral resources available included species of the immediate marsh, riparian, and coastal environments, supplemented by those of the coastal sage scrub and woodland-park communities in the adjacent Santa Monica Mountains to the north. The abundance of year-around sources of food, a supply of fresh water, and situation on a natural route of travel to the interior favored the location as a place for human occupation.

When this project began, the setting was once again different from the conditions recorded and remembered by those who had worked at the site in 1980 (G. Romani, A. G. Toren, and M. McIntyre, personal communications 1985). The project area was deeply buried below sandy sediments. The west, or splitter, levee had been raised and widened on both sides, and the site was covered with a dense growth of vegetation including arroyo willows, sandbar willows, mulefat, giant cane, saltbush, cattail, tule, and water cress (W. Lockhart, personal communication 1985). In 1981, Calleguas Creek was diverted toward the east by VCFCD at the request of the Corps in an effort to protect the site (S. Schwartz, personal communication 1985). Both the stream and west channel carried a substantial flow of water.

#### Summary of Previous Archaeological Work

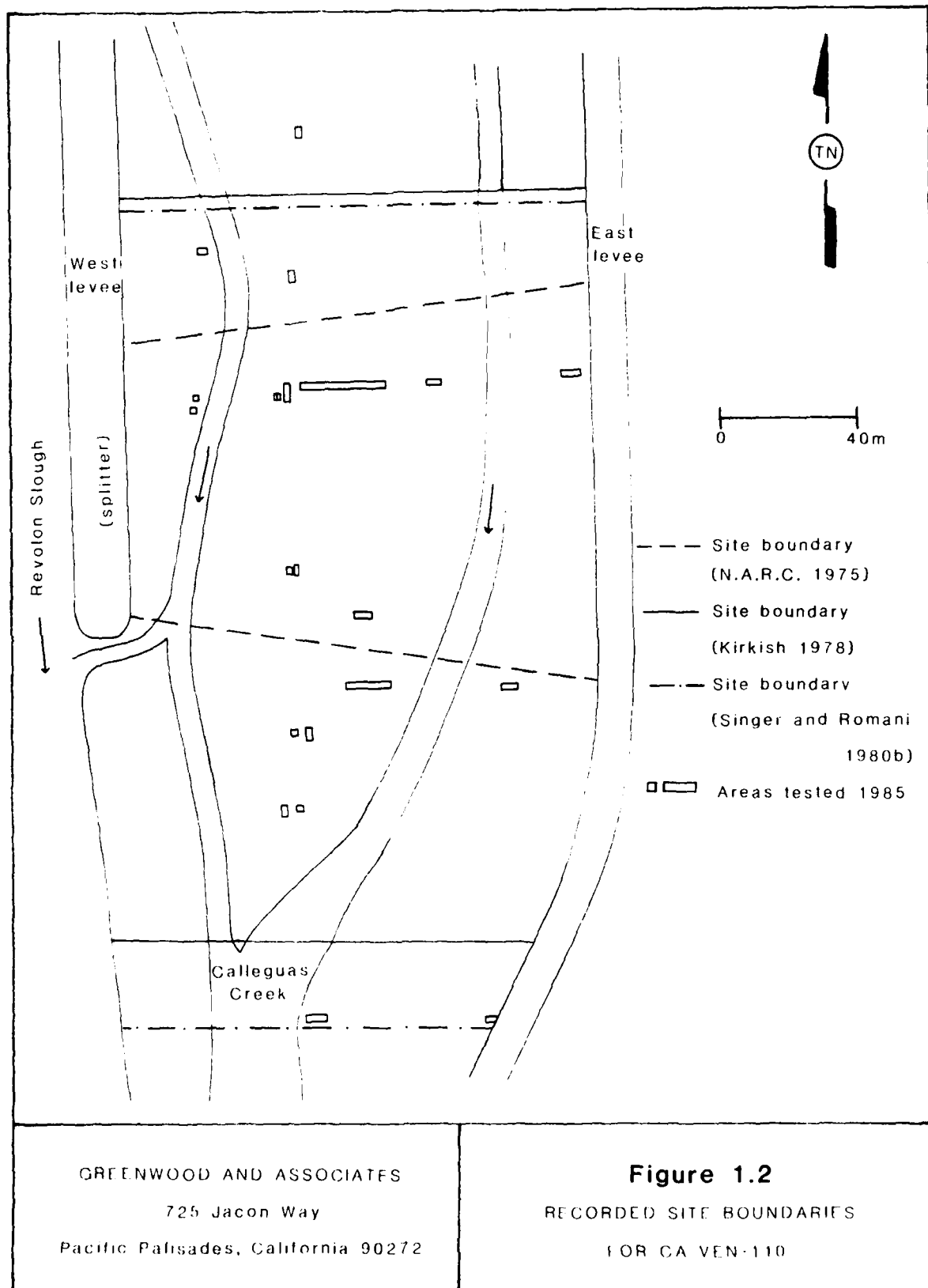
The following pages summarize the known work that has been conducted at CA-VEN-110 since 1959, providing, when the data are available, contemporary descriptions of the site, types of cultural resources reported, extent of the work conducted, the

purpose for the archaeological work, and changes to the site resulting from impacts. The areas discussed are indicated on Figure 1.2.

Beechert 1959: The first known archaeological work at site CA-VEN-110 was conducted in 1959 by Dr. Ed Beechert of Ventura College with volunteer assistants Robert Browne and Bill Norton. The only information about the project is contained in Browne's field notes dated April 11, 18, 15, and May 9, 1959. Mention is made of a stone bowl which had been collected by Tom Meager (then a State Park ranger), but there is no suggestion that he participated in the excavation. The notes are very brief and do not provide a datum or reference point for the five square units which were staked, the number or volume actually excavated, the size or depth of the units, or description of the methods utilized. There is no estimate of overall site size or description of its appearance beyond the comment that the human remains were below tide level and a dam was built to facilitate the work. The clay was found all but impossible to screen, but at least some of the dirt was removed to be washed.

The area excavated is somewhere near the southern end of the site, along the east bank of the western drainage channel (M. McIntyre, personal communication 1985). Two stratified "sites" (midden components) - the lower one described as 12" thick with solid shell - separated by an unknown depth of sterile sand, were reported in the notes. Tidal inundation periodically submerged the lower component and more than half of the upper sterile sand zone.

Three flexed burials (presumably adults), described as being in "bad shape," were exposed, sketched, photographed, and removed from the lower component. Burial #1 was recorded as lying on the right side, superimposed on the pelvic area of Burial #2, with its "head broken," facing west. Several finished and unfinished steatite beads, approximately 3 in long, and many



small shell beads, "...some of them the tip end of olivella shells," were found nearby; a sketch shows that some were around the neck area. The context of the burial was described by Browne (April 18, 1959):

The sand under #1 showed where it had been dug out and it had a deposit of dark brown substance about 1/2" thick under the bones on top of the dug sand.

Burial #1 - black fibrous material shot through with [illegible] coloring over and underlaying burial. Appears to follow pit outline.

Burial #2 was slightly northwest of Burial #1, with the latter burial overlapping the pelvic area although the pelvis, and presumably also the leg bones, were reported missing. This burial was described as flexed on the back with the head on the right side, facing southwest. No artifacts were recovered in situ, although a large (5 x 2.5 cm) black chert leaf-shaped projectile point was later "screened out of #2 Burial." Two "unstones" (unburned or unmodified?) were also recorded, one over the abdominal area and the other just northeast of the back of the head.

The third burial was said to be five feet southeast of the other two, in a sand deposit above the clay. It was flexed on the right side, facing south, with the hands by the "jaw." A projectile point and bone fishhook, not otherwise described, were recovered with the burial. At some later date, the human remains were turned over to Charlie Cooke for reburial (R. Browne, personal communication 1985).

Other artifacts mentioned include the following: a small granitic basket mortar (6" diameter, 4" high) and a stone bowl, both located in the stream just east of the burials; a large amount of broken and some unbroken shells, two trade beads, three or more shell beads, a "flint drill," and some Grimes Canyon

fused shale flakes from the screening of Pit S-33 E9; a eucalyptus pod 6" above the burial ground; and "un. stone," "un. shale" (unburned or unmodified?), burned stone, a quartz crystal, and bone from an area near the basket mortar, perhaps 10-17 feet from the burials. Some beads were unfinished.

Included with the notes is an unlabeled photograph of a distinctive stone bowl with a spall missing from the rim. It has straight, outward flaring sidewalls and a wide, flat rim decorated with alternating circles and transverse grooves. This may be the one collected by Meager.

McKusick 1959: The site was first recorded with a trinomial on December 8, 1959 by Marshall McKusick. It was then described as a shell midden of unstated dimensions, located "north of Hwy 1 on Calleguas Creek and west of dirt road on John Broome Ranch." Artifacts mentioned included "bowls and pestles (one bowl with inlaid shell beads, apparently Canalino)." McKusick's comment on the possibility of destruction stated that it was "largely destroyed by swamp drainage ditch." A further comment by E. Beechert adds: "Calleguas Creek diverted approximately 1892 into present area; erosion from flooding has cut Mugu location back to present site."

Browne 1974: On February 20, 1974, Robert Browne monitored the cutting of a backhoe trench into Revolon Slough, westerly from the approximate middle (north-south) point of CA-VEN-110. The trenching was done at the request of Mr. Bill Lockhart, Ventura Flood Control, as a test to determine if the site extended west from the Calleguas Creek channel into the Revolon Slough channel, since further channelization work was being planned for the latter.

The trench was dug by a large backhoe situated on top of the central (splitter) levee. The cut was approximately 25 feet long and 14 feet deep. The uppermost 8 feet were described as a



deposit of sterile silt, whereas the lower 6 feet were layers of sand and mud, considered to be similar to lagoonal deposits. The lower levels contained California horn shell and California jackknife clam, which were interpreted as not constituents of the midden component at CA-VEN-110, but only animals indigenous to lagoonal habitats. The species said to compose the cultural midden were Tivela, Saxidomus, Chione, Protothaca, Mactra, Haliotis, Pecten, Mytilus, Polinices, and Ostrea. Based on his interpretation of the trench, and presumably from his experience in excavating at CA-VEN-110 in 1959, Browne concluded that the site did not extend westward into Revolon Slough.

In his letter (February 1974) describing the backhoe trench findings, he further commented:

A small amount of work was done at this site in April 1959 by a class from VCJC. At this time there were two distinct levels of midden. However, the upper level appears to have been all removed, either by flood waters, or work being done on Calleguas Creek. The lower level still shows in the present stream bed of the Calleguas Creek.

Briuer and McIntyre 1975: In August 1975, the Northridge Archaeological Research Center, at California State University, Northridge (NARC/CSUN), undertook an archaeological survey "to identify and assess the archaeological resources along the entire extent of the planned channelization of the Revolon Slough and Beardsley Wash, and associated drains" for the U. S. Dept. of Agriculture, Soil Conservation Service (Briuer and McIntyre 1975:1). The further purpose of the project was to determine the potential impact to archaeological resources from the channelization improvements proposed for both Calleguas Creek and the adjacent Revolon Slough. One of the archaeological sites within the right of way was CA-VEN-110, but a systematic recording of the site was not possible because of lack of visibility.

The true extent of VEN-110 at this time cannot be evaluated

due to the fact that at least 80% of the site is covered by sand and silt and it is covered by water for about 2/3 of the day. This made it impossible to map the full extent of the site and to assess the site from the surface indication (Briuer and McIntyre 1975:6-7).

It was therefore recommended that a subsurface assessment be conducted at CA-VEN-110 since the available data did seem to meet the criteria for nomination to the National Register of Historic Places, although additional information would be necessary to complete the form. The following quotes from the EIR document describe the site in 1975:

One site (VEN-110) is located in the middle of Calleguas Creek right before Calleguas Creek and Revolon Slough join (see Map I). This site was evidenced by a concentration of broken bowls (most of them burned), scattered human bones (exposed by illegal pothunting), a heavy concentration of shell, a few flakes, and possible associations of burned earth, rocks, and shell (Briuer and McIntyre 1975:5).

Based on the limited surface evidence we saw, VEN-110 has a cemetery (sic) and areas for shell processing. It could possibly be associated with VEN-167 slightly to the north or VEN-24 (sic), the village of Simo'mo. Field notes from the 1959 excavation show that the site had two levels of middens separated by a level of sand. The artifacts mentioned in the notes indicate either a middle or Late Period occupation (Briuer and McIntyre 1975:7).

An enlarged topographic map (Briuer and McIntyre 1975:Map 1) depicts the site as approximately 400 feet (121.9 m) wide (east-west) from the west bank of Calleguas Creek to the base of the splitter levee. The north-south dimension is shown as approximately 500 feet (152.4 m) along the creek, and 350 feet (106.7 m) at the levee. The area covered is roughly equivalent to 1.6 ha or four acres.

The predicted impact from the proposed improvements for both Calleguas Creek and Revolon Slough was almost complete destruction of the site as the result of channelization, associated construction activities (e.g., turn arounds, borrow and storage areas), and human vandalism. It was further stated that, "the higher volume and velocity of the flow would accelerate erosion of this site which is already being slowly washed to sea" (Briuer and McIntyre 1975:8-9). The alternatives suggested to avoid further impact to the site included: (1) no project, (2) redesign of the project in the area of Lower Revolon Slough and coverage of the site by fill, and/or (3) a test followed by mitigation excavation of the site (Briuer and McIntyre 1975:9-12).

McIntyre 1975: In September 1975, NARC/CSUN conducted a minimal subsurface archaeological test program at CA-VEN-110 in order to assess site significance for potential nomination to the National Register of Historic Places. A series of test pits, number, depths, and locations unknown, was excavated through the silt overburden along a north-south and east-west axis from a datum point located near the south central portion of the site. They were pursued to the top of midden to determine the horizontal extent of the site. This was augmented by examining the bank profiles of the water channels for midden exposures.

Relative dates were obtained from the beads that were recovered by wet screening (sluicing in the creek), materials eroding in the area of Beechert's 1959 cemetery, and at some "point" to the north. From the beads recovered by both this test and the 1959 excavation, Chester King concluded that the types were representative of the Terminal Middle Period (approximately A.D. 1100) and Late Period.

A minimal individual count was also accomplished by wet screening or sluicing the creek for eroding human bones in the burial area. Although the identified elements were not specified, the remains

were said to represent four individuals. Therefore, at least seven (three from 1959) burials had been recorded from the site. All artifacts and human bones were reinterred into the deepest test pit, 2-S, location unknown.

The site was calculated to be approximately 105 meters wide (E-W) and 128 meters long (N-S). In addition, three water channels were roughly mapped, the largest being the eastern channel, with another following close to the western/splitter levee, and a third smaller channel flowing through and causing erosion in the burial area. The general site description is as follows (McIntyre 1975: Item 7):

The site as it exists now is covered by 50 to 150 cm of sand and silt as the result of the drainage action of Calleguas Creek. Parts of the site have been eroded away by the low water drainage of Calleguas Creek (see Map I). The site itself is a shell midden with an associated burial area. The shell midden is approximately 15 cm at its thickest point...Original environment at the time of occupation would be one of a delta-like ecozone. Calleguas Creek was diverted through the site in approximately 1892.

The site was listed on the National Register of Historic Places on May 19, 1976.

McIntyre 1976: In January 1976, Michael McIntyre, then NARC President, and several other NARC surveyors visited CA-VEN-110 and found further disturbance had occurred. McIntyre addressed a letter dated January 19, 1976, to A.P. Stokes, Director, Public Works Agency, County of Ventura, with copies to William Seidel, State Parks Archaeologist, History Preservation Section, and G. H. Stone, State Conservationist, USDA-SCS, describing the disturbance and expressing concern for the site. At the time it was not known what party, private or governmental, was responsible for the action. The disturbance was described as follows:

...the area around 110 had been disked. The site of 110 was

actually disturbed with the midden along the eastern boundary being disked. Also, further potting occurred in the burial area with more burials being discarded in the creek (McIntyre, Jan. 19, 1976).

Kirkish 1978: Alex Kirkish, Archaeologist for Ventura County Flood Control, monitored that agency's removal of debris from above the site on September 13-15, 1978. Although the notes are somewhat sketchy and less than clear as to exact locational data, a number of interesting observations were made.

Based on a sketch map, at least three sizeable water channels existed at that time. Midden was found west of stakes on the east bank, exposed primarily on the bank in the vicinity of Station 9 (coordinates taken from Station 9 were 100'N/8'W to 112'S/128'W) at 1/2" (sic) above grade. It was described as a dark, oily, ecofactually rich soil. Although some degree of the site was exposed, it was later said that no midden was impacted during the grading operation. The grade level was then raised 1.5 feet to avoid further impact. Two sketch maps suggest that this location is the land adjacent to the east levee.

The operation then moved to the first island west of the east levee. No cultural materials were observed down to grade level. Kirkish commented: "Given the lack of cultural material at grade on island and the presence of material above grade on east bank, it quite possible that the site (cultural deposit) dips to center of creek" (Dec. 14, 1978). The profile on his one drawing shows the midden as a concave deposit from levee to levee. He suggested that, "This occurrence may be due to active erosional factors in middle of creek."

Exposed midden was observed on the west bank of the creek and within the creek bottom below grade: "Station #9 104 N/46 E = exposed area 3" (sic). It was described as a black shell midden composed of 75% shell ("pecten, clam, haliotis"), fire fractured

rock, and possibly hematite. The midden was also observed in the bank of the western island, about 11" below the surface. Machines were not allowed to cut this area.

Around Station 3 of the east bank, the overburden was removed down to grade level with no cultural resources exposed. On the basis of the boundaries plotted at that time (Singer and Romani 1980a:Map 1), the site in 1978 was said to be 243 m north-south by 105 m east-west (Figure 1.2). Kirkish (12/15/78) concluded:

It is apparent to me that most of the undisturbed midden exists on these islands which occupy the middle of the creek. -believe that approx 1' to 1 1/2' feet of sterile overburden exists on islands.

Singer and Romani 1980a: In March 1980, staff members from NARC/CSUN were requested by VCFCD, on behalf of the Soil Conservation Service, to conduct a systematic test for cultural resources in areas adjacent to CA-VEN-110 - to the west in Revolon Slough, and in the area south of the central levee. The purpose of the project was to determine if associated cultural resources extended west and south of the channelized Calleguas Creek, prior to the proposed modification of Revolon Slough. The construction would involve the excavation and relocation of the existing westerly levee of Revolon Channel, using the excavated material to build a new levee approximately 80 feet west of the existing one. The easterly levee (central/splitter levee) was to be built up slightly, with an additional 18" of rip-rap emplaced on both side slopes. The southern toe of the central levee was also to be encased with rip-rap (Singer and Romani 1980a:1). The area of potential impact included the southern portion of the east bank of Revolon Slough, extending south into the sandbar extension of the central levee, bordering a section of the very southern west bank of Calleguas Creek, west to the west Revolon Slough levee, and extending approximately 80' further west into the agricultural field (Singer and Romani 1980a:2).

The methodology entailed (1) background research, (2) surface survey and shovel scrapes of the surface and banks of Calleguas Creek and Revolon Slough, (3) mapping the exposed midden area of the west Calleguas Creek bank, and (4) excavation of 24 backhoe trenches in four general areas. The testing was dispersed as follows (Singer and Romani 1980a:10):

- (1) Five trenches along the sandbar south of the central levee.
- (2) Two trenches along the west bank of Calleguas Creek, adjacent to the southern toe of the central levee.
- (3) Seven trenches along the east bank within Revolon Slough, at approximately 100 foot intervals, extending about 200 feet north of the known northern boundary area.
- (4) Ten trenches west of the Revolon Slough levee, five along the bank and five in the field.

The trenches were excavated an average depth of three meters, at least 1.5 meters below the calculated midden level on the west bank of Calleguas Creek. Twenty-three of the backhoe trenches revealed fairly consistent deposits of silt overlaying grayish sand, with only a very few shell fragments encountered. Only Trench 15, abutting the west side of the west Revolon Slough levee revealed some thin darker soil with shell at approximately 60 cm deep, and only in the very eastern end of the trench. However, the levee adjacent to this trench was apparently constructed of mixed midden material and was somewhat slumping to the west, undoubtedly into the trench area.

It was concluded that if the site did once extend west into Revolon Slough, it had either been subsequently eroded away or was used as part of the construction fill for the levees; cultural materials were very evident throughout the levee systems (Singer and Romani 1980b:13), as they are in newer construction as well. Since the only cultural remains visible in this area were exposed along the west bank, within the western channel, and in the western channel bank profiles, the assessment of potential

impact upon cultural resources in Revolon Slough provided only a minimum of new data about CA-VEN-110.

More useful was the effort to delimit the site's northern, southern, and western boundaries as an aid in assessing Revolon Slough. An area approximately 200 feet north-south (from survey stake 8+00 to just beyond 10+00) was found to have semi-intact loci of residual midden deposits, the result of severe impact caused by scouring and infiltration from Calleguas Creek. The exposed surface midden seemed to represent the basal portion of what was possibly the upper component. Minor subsurface probes with trowels in the area of Feature 21, which had residual surface midden, revealed a second midden 30 cm below a sterile silt lens, although the depth of this lower midden was not determined. Subsurface midden was found below Feature 15 (at 30 cm), at Feature 16 (at 5 cm), and possibly at 35 (at 15 cm). At low tide, buried midden was also observed in the western bank cut below uneven silt deposits which were at least 25 cm thick.

The uneven surface of the western portion of CA-VEN-110 was represented by (1) residual midden caps: slightly elevated thin lenses of midden (8-10 cm thick) between strata of culturally sterile silt; (2) midden pockets: midden exposed in depressions resulting from natural scouring or deliberate removal of the silt overburden; and (3) scattered artifacts and ecofacts, along with four possible disturbed hearths, above both the culturally sterile silt and loci of midden lenses. Where measured from Datum 1, the upper surface of the midden was found to occur 8-10 feet (2.45 to 3.0 m) below the top of the levee. Since no systematic testing occurred, the exact nature of the deposit remained unknown but clearly complex.

Singer and Romani 1980b: In August and September 1980, NARC/CSUN conducted a systematic test for Ventura County Flood Control District, to determine the horizontal extent of CA-VEN-110 and



define the depth of overburden covering the site. This test was completed in order to avoid direct impact to the cultural resources during the anticipated removal of sediments; the objective was thus to find a grade level that would avoid the site and establish an overburden buffer zone. The test was not designed to test the actual depth of the midden, but only to reach the top of the deposit. The archaeological work included: (1) intensive surface survey of the banks, stream beds, and island area of Calleguas Creek and adjacent areas, (2) excavation of hand-dug post holes at designated points on a grid that included ground surface elevations, and (3) shovel scrapes to profile the banks of the stream cuts.

Initially, the test area extended from a point approximately 300' upstream from the Highway 1 bridge, north to approximately 1300' upstream (approximately 1000' north-south), and from the central levee to the east Calleguas Creek levee (approximately 600' east-west). This would have included an additional 100' south and north of the projected site boundaries. However, due to the seasonal drop in Calleguas Creek flow, particularly in the western channel, the crew was able to walk the channel and observed sparse, patchy cultural materials in the bed of the creek. Most of the bank area farther north was heavily obscured by vegetation. The post hole grid ultimately extended 3300' north from the Highway 1 bridge. Pockets of midden containing shell and bone, and possibly burned rocks were found in the stream channel to a point approximately 3100' upstream from the bridge. During this assessment only two water channels existed, forming a large elongated island between the two flows.

During the initial phase of the project, 43 post holes were excavated at or near the intersection points of the 100 foot grid to either (1) midden surface, (2) water, or (3) maximum reach of the postholer. By first digging larger diameter holes with shovels, the range of the postholer was extended to an average of about 5 feet. After materials were observed along the

western channel, an additional 41 post holes were excavated at 200 foot intervals. Test results and artifacts are listed in Appendix 1 of Greenwood, Foster, and Romani (1985).

Surface evidence of the site was found only in two locations: (1) just east of the control/splitter levee between stations 8+00 and 11+00, extending out to the west channel approximately 80-90 feet, with what seemed to be redeposited materials (primarily shell or shell clusters lacking any type of midden or dark soil context) extending about 125' (40 m) south, and 100' (30 m) north of the primary, but scoured appearing, deposit.

Silt removal operations were subsequently monitored by Gwendolyn Romani and Kote Lotah, representing Candelaria, between Dec. 8-12, 1980. The area supervised extended from "Center Line Station 2" (approximately 220 feet north of the Highway 1 bridge along the east bank) to Station 16 and included the east bank and island area. The west bank area was not affected, from Station 0 to Station 14.

During the monitoring only one thin, discontinuous lens of midden (1/2 to 2 inches thick), approximately 3 feet x 4 1/2 feet in area, was exposed by a scrape, which removed 3-4 inches of material per sweep. This area was approximately 15 feet west of the east Calleguas Creek levee, and approximately 50 feet from Station 10. Numerous trowel probes to at least one foot failed to reveal any further deposit, and grading was allowed to continue to grade level with no further exposures. Site size at that time was depicted by the Singer and Romani investigation (1980a) as 660 m north-south by 122 m east-west (Figure 2.2).

#### Summary

Based primarily on the observations of Briuer and McIntyre (1975), Kirkish (1978), and Singer and Romani (1980b), it would appear that the site once extended at least from the east Calleguas Creek levee to the base of the west Calleguas Creek

(or central/splitter) levee. In 1975, midden was reported as far as the east levee; midden was exposed on the east bank in 1978; and in 1980, a fairly large area of a patchy, discontinuous midden was exposed adjacent to the east levee that extended west on the east bank. A very thin midden stratum (<2 cm) was uncovered during silt removal operations. Although the material could have been redeposited, a midden context inclusive of ecofactual materials would not be expected, particularly in the configuration and size of the area visible on the surface around D3 (1980b). Other material observed, which was deemed redeposited, included a variety of shell types, either complete or broken, found singly or in clusters in a sandy matrix without a surrounding context of midden, or the trees, auto parts, and plastic trash noted by Kirkish one to two feet above grade (1978).

The north-south extent of the site is a more complex and still unresolved question. At the north end of the 1980 test grid, only one post hole (C23) encountered a dark, thin shell midden, while within the west channel, small shell midden patches occurred sporadically over the dark brown clay. Eroding materials were observed along the stream banks beyond the test pattern as far north as a point opposite Simo'mo (C. Singer, personal communication 1985). Otherwise, only a few shell fragments were encountered in light colored sand or silt deposits. Without demonstrable midden context, redeposition is conceivable, but whether the materials originated from Simo'mo or from a northerly extension of CA-VEN-110 is not presently known. Over the years, cultural material and human remains have also been observed as far south as the highway, but these are more securely attributed to erosion induced by periodic floods, tidal action, pothunting, and the repeated dredging.

It is documented that seven burials had been excavated prior to this investigation, in addition to the many fragmented and isolated bones witnessed on the surface or eroding from the

banks. Reported features include areas of burned soil with charcoal (Briuer and McIntyre 1975; Kirkish 1978; S. Schwartz, personal communication 1985). The depth of the deposit had never been tested, nor was there any quantification of the midden constituents to suggest relative densities over the horizontal expanse.

The research previously conducted at Muwu and Simo'mo has been summarized in the Research Design (Greenwood, Foster, and Romani 1985). In addition there are many other recorded sites in the immediate vicinity, some of which have been extensively excavated and reported, e.g., CA-VEN-100 (West 1979).

#### Research Design

The Research Design was developed on the basis of the reports summarized above, detailed environmental data, results and hypotheses derived from excavations at Simo'mo (CA-VEN-26) and Muwu (CA-VEN-11), the cultural and chronological sequences advanced in regional overviews, and an estimation of what a test excavation could reasonably be expected to achieve (Greenwood, Foster, and Romani 1985). The objectives expressed by the Corps of Engineers focused the inquiry toward a set of questions which would confirm the potential scientific significance of the site, if the data required to address such questions were found to be present. It was not predicted that the test would solve the research problems, but rather, the field work would assess the nature and integrity of the cultural deposit.

The underlying theoretical orientation is based upon two assumptions: that it is possible to distinguish between a location devoted primarily to maintenance activities and one specialized in extractive activities, and that subsistence patterns have fundamental consequences upon settlement and social organization (Binford 1980). A maintenance site (village or base camp) is a place where relatively large numbers of people,

probably differentiated by age and sex, carried out a wide range of economic and social activities. Models of adaptation are reflected in Binford's distinction between "collectors" who tend to carry the resources to the consumers on the basis of specialized economic activities removed from the main habitation site, and "foragers" who tend to practise residential mobility in response to the availability of resources (1980).

Such models, and the approach applied to CA-VEN-110, have been characterized as the middle-range level of theory building (Raab and Goodyear 1984) and regarded as the most appropriate when only limited information is available about a site. Beyond satisfying the need to assess integrity, it was intended that the recovery, preliminary analysis, and interpretation of the data sought would help place the site into larger models of human ecology so that any further studies could then seek explanations for settlement patterns, social evolution, and interactions between social and physical environments.

The more general, first-level questions most applicable to the test excavation were those which could be addressed through basic methods of analysis: qualitative, quantitative, presence/absence, radiocarbon dating, etc. The purpose of the following questions is to establish and evaluate the parameters of the research potential (cf. Appendix 9).

1. Did CA-VEN-110 function as a village, or was it a more limited occupation, e.g., specialized for ceremonial, procurement, or processing functions ?
2. Was the occupation of CA-VEN-110 contemporaneous with Muwu and Simo'mo ?
3. Was there any demonstrable change in the function of the site through time ?

4. Was utilization of CA-VEN-110 intensified on a seasonal basis ?

5. Was there a shift in the subsistence base through time ?

6. Is the midden temporally and functionally associated with the cemetery ?

The Research Design also included a preliminary set of second-level postulates which would require specific data sets, more intensive analysis, and greater comparison to Simo'mo and Muwu. It was not expected that these could be addressed within the constraints of the testing program, but they were provided as examples of the kinds of hypotheses which could be generated if the requisite data were found to be present and intact. The degree to which such problems could be addressed would be one criterion of site significance, and each was presented with the underlying assumptions, justification, and test implications (Appendix 9). These postulates are summarized as follows:

Statement 1. The population from Simo'mo moved to CA-VEN-110 ca. A.D. 1300 and continued there the previously defined cultural traditions and patterns of behavior.

Statement 2. The major settlement of CA-VEN-110 followed a change in the configuration and natural resources of the lagoon which prompted an increased orientation to a maritime subsistence base.

Statement 3. CA-VEN-110 was a major provincial village.

### Organization of the Report

Within the organization of this report, Chapter 2 provides detailed description of the extent and methods of the field work: dates and personnel, trenches, units, and laboratory procedures. In the following chapter, the summary of results includes description and discussion of the units, features, burials, soils, midden constituents, and radiocarbon dates. The artifacts are described in Chapter 4. Chapter 5 synthesizes the information according to the problem domains, and Chapter 6 summarizes the conclusions and recommendations. Supporting data beyond the needs of the discussion and the consultants' reports are included in the appendices.

## 2. DESCRIPTION OF FIELD WORK

### Introduction

The methods employed in the test excavation of CA-VEN-110 were designed to gather information needed for site management. To assess its integrity, it was necessary to relocate the deposit presently buried below dense vegetation and a thick overburden of sediment, determine its depth and present horizontal extent, and evaluate the past impacts from natural erosion and flood control measures. To support an informed opinion about site significance required the recovery and analysis of sufficient cultural material to justify statements about its research potential and the integrity of the deposition.

Following acceptance of the Research Design and coordination of all necessary permits (Coastal Commission, Department of Fish and Game, Fish and Wildlife Service, Ventura County Flood Control District, Ventura County Public Works) by the Corps of Engineers, the field work began with preliminary logistics, mapping, trenching, augering, and site set-up accomplished during the week of July 1-5, 1985. These tasks required 8.5 person days. The hand excavation, field laboratory operation, further trenching, and backfilling utilized 135.5 person days between July 8-25. Completion of the sorting and catalogue occupied an additional 37 person days after the site was closed. Those participating were: Roberta S. Greenwood, principal investigator and laboratory director; John M. Foster, project manager; Gwendolyn R. Romani, field director; Patricia A. Morse, laboratory supervisor; Christopher Webb, Byron Estes, A. George Toren, Christopher Kavanaugh, and Bruce Gothar, excavators; Dan Larson, Alan Corbin, and Anna Tinoco, wet screeners; Rita Valenzuela, Elga Stepan, Laurance Zackiewicz, and Helga Girey, laboratory technicians. The basic full-time crew numbered 13; not all of those named were present for the full duration.



Consultants in the field and those with additional responsibilities included the following: Christopher Webb, osteologist; Barbara Pritzkat, surveyor; and Tony Morgan, geomorphologist. The designated Native American monitor was Rita Valenzuela, with Edward Valenzuela as substitute. Anna Tinoco was an additional Native American assistant. Special studies after the excavation were conducted by Beta Analytic (radiocarbon), Chester D. King (beads), James Schoenwetter (palynology), and fish otoliths (Richard Huddleston).

#### Preliminary Tasks

Prior to the full field operation, certain organizational and testing tasks were accomplished by the supervisory personnel and one or two aids, as required.

a. Auger borings were made in the western area of the site where previous investigations had reported the presence of potentially intact cultural deposits. The primary objective was to determine the thickness of the sediments covering the midden and, if possible, the depth of the midden. The equipment was a hand-held auger with 10 cm barrel, with penetration length of 1 m. The recovered cores were tested to assess the optimum method of processing samples through the 1/8 in mesh: wet, dry, with and without the use of detergents or other preparations. It became apparent at this time that wet screening would be necessary, with the assistance of pumps to supply a high volume of water under considerable pressure. Soaking the soil in buckets to loosen the adhesive mud was not measurably assisted or speeded by any of the preparations tested.

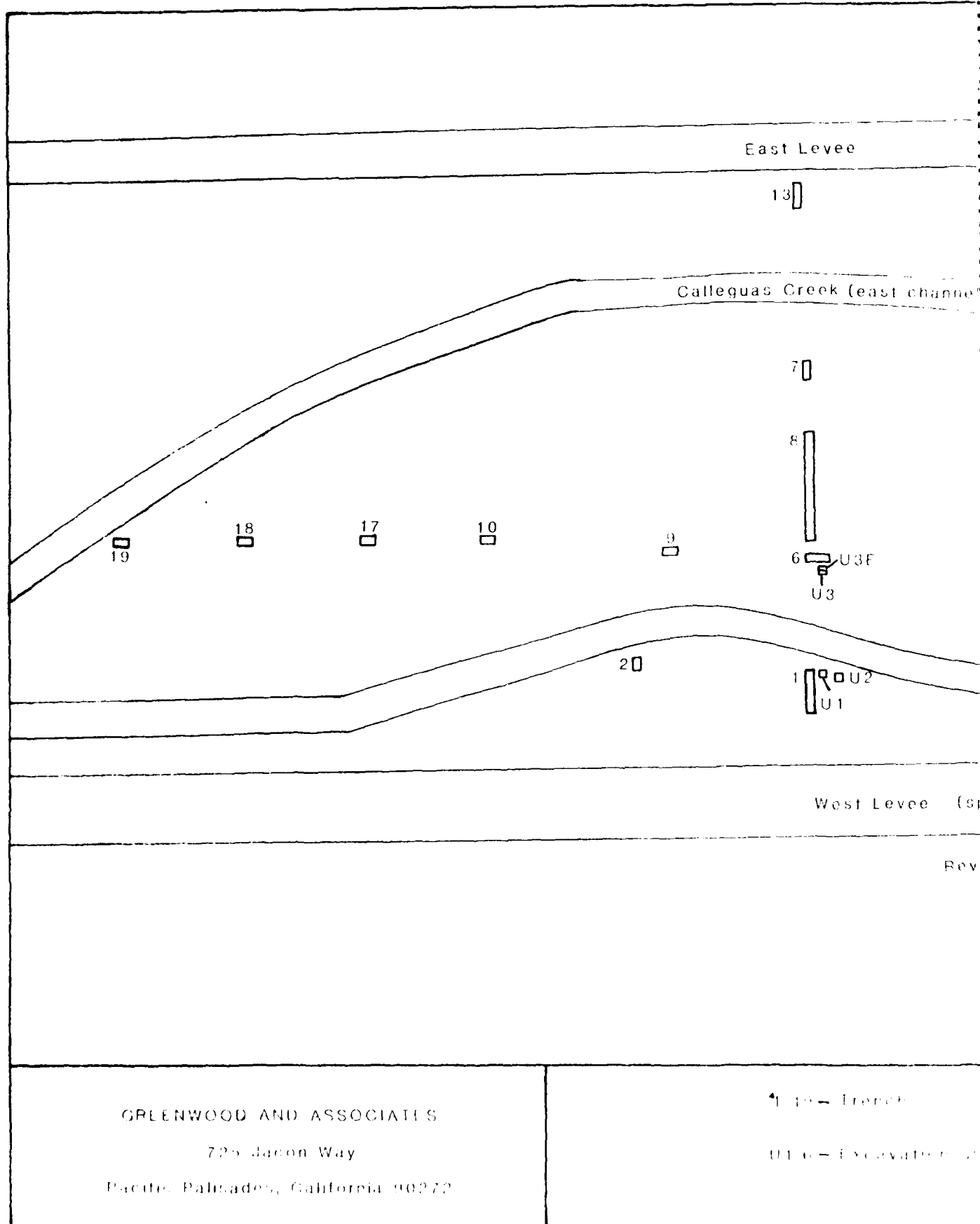
b. An attempt to keep the study area as dry as possible was made by sandbagging the western water channel as far south as possible. Approximately 50 jute bags, lined with heavy plastic trash sacks, were filled with silty sand and, at low tide, used to create a temporary dam three bags high and two bags wide.

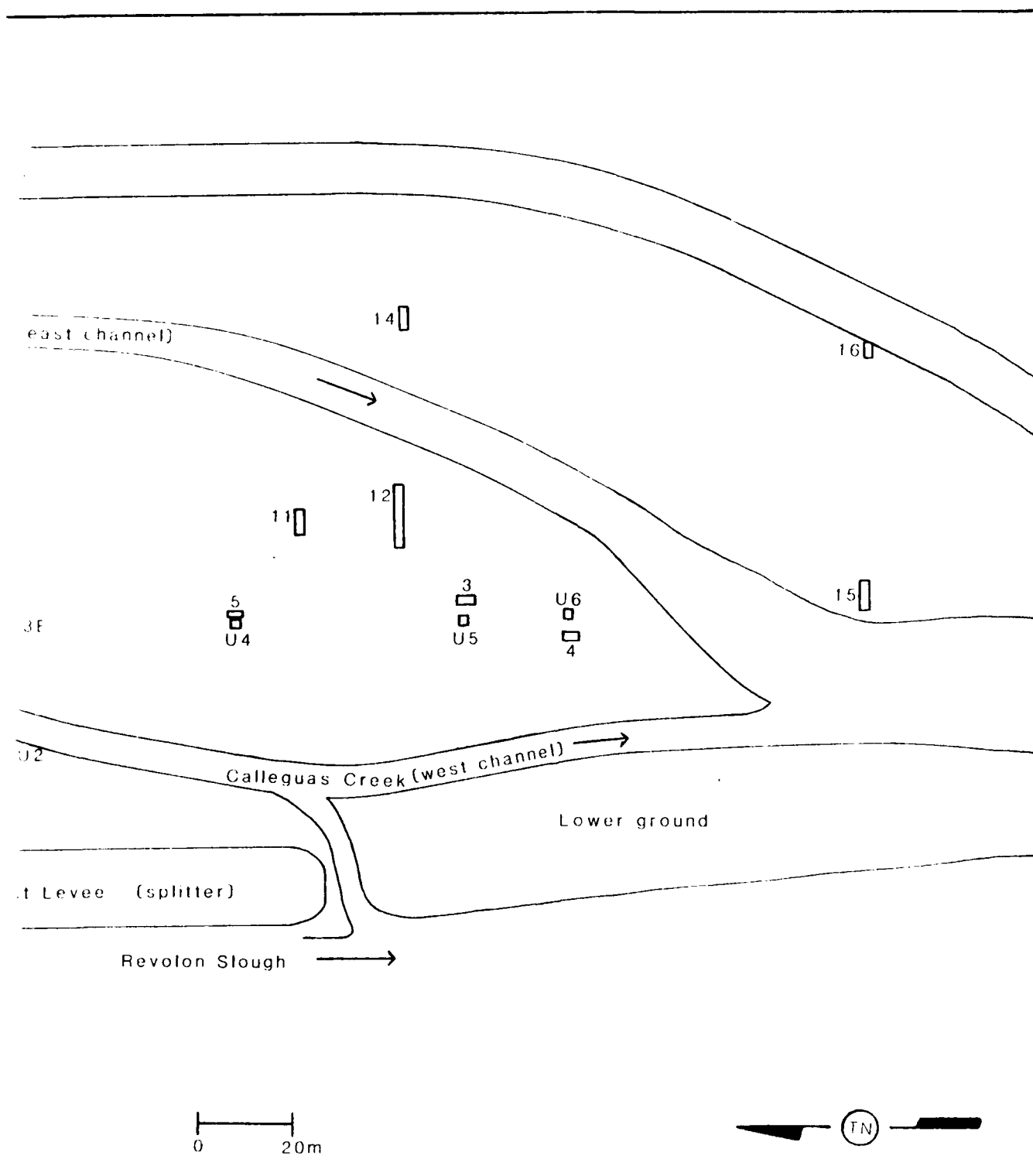
This westerly channel had once been a bed of Calleguas Creek, but had been dammed north of the site about 1981 in an attempt to prevent further erosion. Since the level of the channel was visibly affected by the daily tides, the hope was that the sandbagging might help to keep the excavation units dry by blocking at least some of the tidal influx. However, the next incoming tide broke through the barrier, and the effort was abandoned.

c. Excavation equipment, wet screening apparatus, drying racks, pumps, and hoses were transported to the site, set in place, and made operational. The field laboratory was established in a level, open area between the levee which provided vehicle access and the washing/drying operation.

d. The first backhoe work was also conducted in advance to cut stratigraphic trenches, confirm locations of the midden, and remove excess overburden in areas selected for the excavation units. The equipment was also used to clear pathways and create a temporary land bridge for access to the "island" or peninsula between the west channel and the main flow of Calleguas Creek. Details and methods of this and the subsequent use of mechanical equipment are described below.

e. It was originally intended that the 100-foot grid established by surveyors from the Ventura County Flood Control District for the 1980b archaeological test would be used for horizontal and vertical control points, to relocate the deposits observed at that time, and permit assessment of changes in surface elevation. However, not only did the costs quoted by the District prove prohibitive, but Station 7+00, which was used as control point and datum in the 1980a and 1980b investigations, had been destroyed when the west (splitter) levee was raised and widened. Flood Control surveyors provided instead a datum and two reference points on the east levee, and project mappers had to survey the site from that distant point, across the two streams





ench  
excavation unit

Figure 2.1

CA-VEN 110 SITE MAP

and through extremely dense vegetation. They used a Dietzgen transit and stadia rod where possible to determine bearings and elevation of cultural and natural features, trenches, and units, relying on a 30 m linen tape where transit scope measurements were impossible.

### Field Work

#### Machine Trenches

The backhoe/blade scraper assisted the work before, during, and after the controlled hand excavation. In addition to the site preparation, the original program called for long and wide east-west and north-south blade scrapes through the sediment overburden to a level just above the midden, as calculated from the 1980b (Singer and Romani) grid points and midden level elevations. This strategy proved impracticable for two reasons: the grid was not re-established, and such long and potentially deep scrapes proved all but impossible for the backhoe, since the silty surface did not provide adequate traction and the overburden was thicker than anticipated.

It was therefore decided to use a series of backhoe trenches, instead of the scrapes, dispersed over what had previously been defined as the central area, to test both the positive and negative results of the hand-dug 1980b test program. The trenches were cut through the overburden into underlying sterile soil to determine whether the deposits extended below the reach of hand-held augers, if more than one cultural stratum, or component, was present, and which locations appeared to have the optimum data potential for the purposes of this test. Factors contributing to this decision include: (1) the large areal extent of the site, (2) unknown nature of the cultural deposit (depth, stratigraphy, and integrity), (3) the amount of overburden that was found to cover the cultural deposit (more than 1 m in most cases), and (4) the need to expose deep soil profiles in order to

study the depositional processes. In all, 19 trenches were excavated: 10 prior to the excavation; six at the end of the second week of field work, plus extensions of two of the original trenches; and three after completion of the units to test an additional area.

The decisions about the location of the initial excavation units were predicated on the 1980 site mapping and the results of the 1985 auger tests and first 10 trenches. The equipment was then used to remove the overburden in a broad area over each target chosen for study so that the hand excavation could begin just above the top of the midden. The cleared exposure, called a locus, also provided easy access to each unit, a level platform for wheelbarrows or other equipment, and precluded the need for shoring. Each locus was created by excavating a series of adjacent parallel trenches perpendicular to one wall of the test trench, leaving the other trench wall intact for reference, profiling, analysis, and drainage. These exposures were cut to approximately 30-50 cm above the uppermost cultural deposit identified in the adjacent trench. The remaining sterile overburden was removed by shovel where units were to be situated. All exposures were cut back with three gently sloping walls and low rounded backdirt piles, to avoid the risk of collapse. Each locus was large enough to accommodate additional units if warranted. Sloping ramps were created to facilitate traffic of both persons and wheelbarrows. Four loci were established originally, and a fifth was added as a result of additional trenching.

The following paragraphs and Table 2.1 describe the test trenches and loci, and the rationale for their placement (Figure 2.1). The equipment was at all times closely supervised by the project manager and field director, who examined backdirt and recorded side wall profiles. The trenches permitted at least cursory examination of 131 cubic meters. Many of the trench locations were conditioned in part by backhoe accessibility,

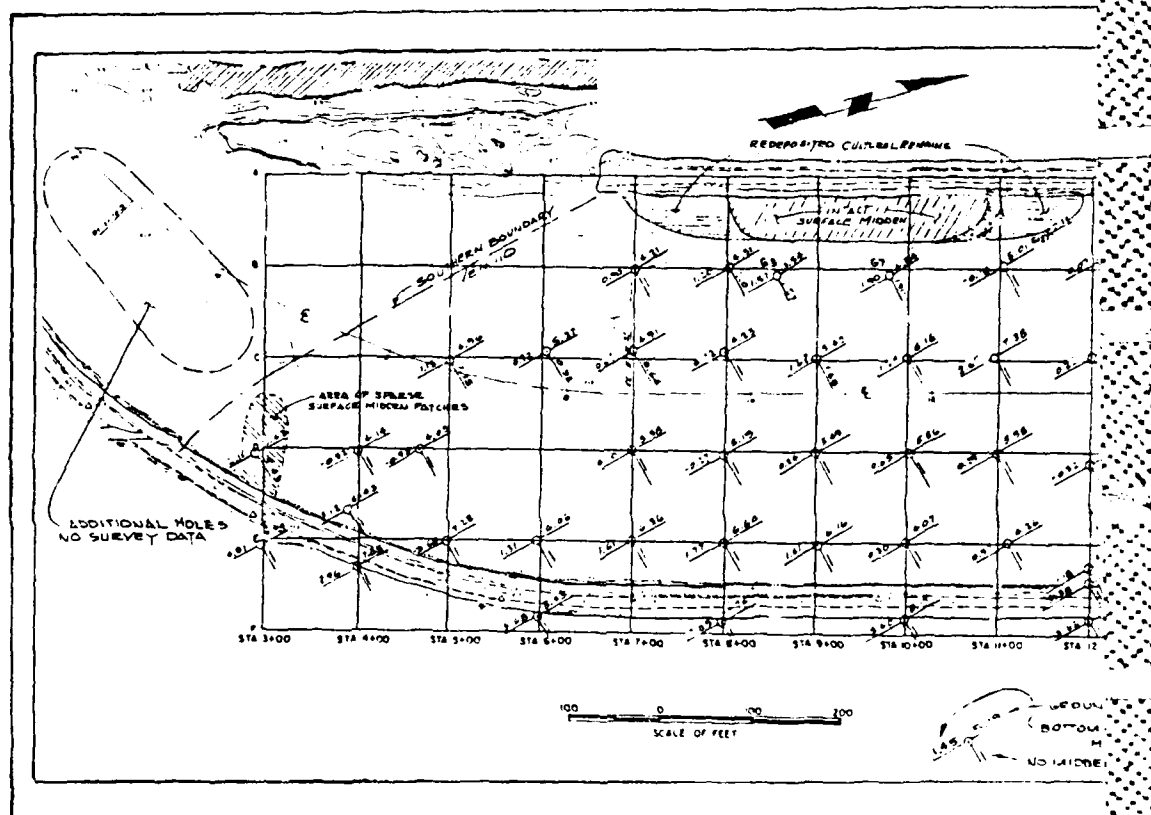
stability of the stream banks, and existing trees. All trenches filled with water to various levels soon after excavation.

Trench 1: This trench was excavated between the west (splitter) levee and the west channel, approximately 30 m north of the southern boundary of the surface midden recorded in 1980 (Figure 2.2). Since 1980, approximately 180 cm of sediment had accumulated unevenly over the area, and the surface was further modified by a new berm. The objective was to test the nature and extent of the previously observed west bank deposit.

Locus 1: Because of the midden visible in the profile, Locus 1 was opened as a south and westward extension of Trench 1. It measured 10 m east-west and 10 m north-south, and was the location of Units 1 and 2.

Trench 2: To test another area on the west bank, where midden had been predicted, Trench 2 was excavated approximately 40 m north of Trench 1. The location is about 10 m south of the northern boundary of the west bank surface midden observed in 1980. The cut began about 2 m west of the west water channel. Sterile, light colored silty sand was observed below the cultural deposit. A broader exposure for a unit was not made, since the trench was cut into a narrow portion of the west bank which would have been too restrictive for the backhoe, equipment, and pedestrian passage. It served to confirm the presence of midden.

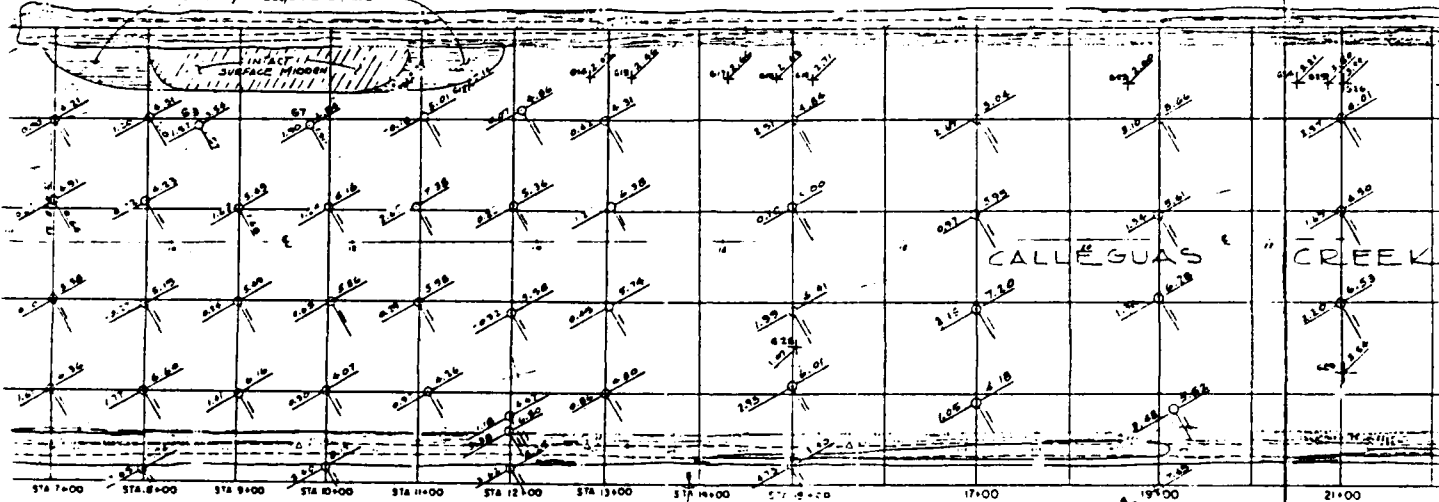
Trench 3: This trench was situated toward the southern end of the "peninsula," at a point that would be approximately 30 m south and 40 m east of the southern tip of the central/splitter levee. The area was within the previously recorded boundaries of the site, and would roughly equate to the area between Lines B and C, just south of Station 6 (Figure 2.2). A thin stratum of midden was encountered over





# MAP 2

REDEPOSITED CULTURAL REMAINS



0 100 200  
SCALE OF FEET

## LEGEND

GROUND SURFACE ELEV.  
BOTTOM OF HOLE ELEV.  
MIDDEN ELEV.  
NO MIDDEN ENCOUNTERED

ELEV AT G STAKE

ELEV BOTTOM OF HOLE AT G STAKE

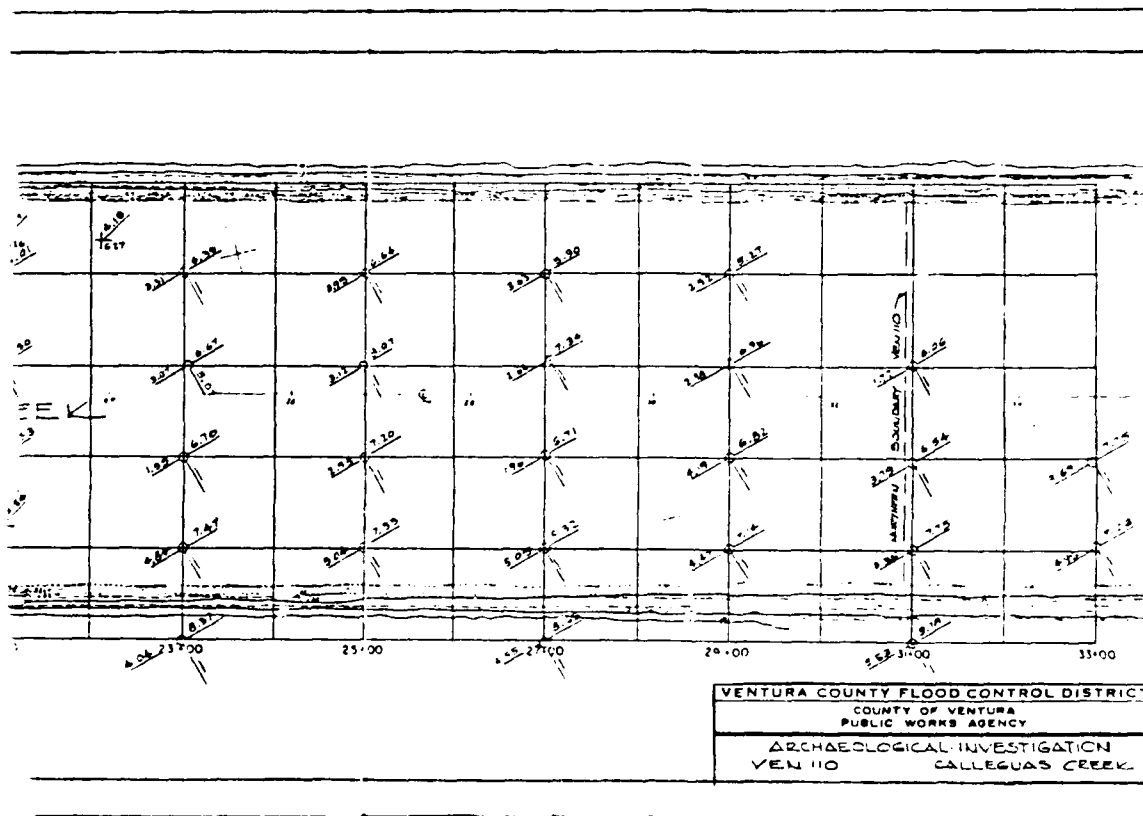


Figure 2.2  
 MAP OF 1980 FIELD TEST  
 (Singer and Romani 1980b)

an underlying sterile, light colored, silty sand.

Locus 4: A broad exposure was dug out as a westward extension of Trench 3, 6.0 m east-west by 3.5 m north-south. Unit 5 was located here to examine the deposit in this area.

Trench 4: The fourth trench was about 20 m south of Trench 3, between Lines B and C, near Station 5 (Figure 2.2). Midden was present above a smokey gray sand.

Locus 5: This exposure was an eastward extension of Trench 4, to open a working area 5 m north-south by 4 m east-west. Unit 6 was excavated here to sample an area which was revealed by Trench 4 to appear unique in both deposition and cultural remains.

Trench 5: The area selected for examination was 45 m north of Trench 3, between Lines B and C, and Stations 7 and 8 (Figure 2.2). The sterile horizon below the midden visible in the profile was a light colored silty sand.

Locus 3: An area was opened as a westward extension of Trench 5, extending 6 m east-west and 4 m north-south, to become the location of Unit 4.

Trench 6: A trench was excavated approximately 50 m north of Trench 5 and 25 m east (directly across the west water channel) of Locus 2. It was situated between Line B and C, Station 9 (Figure 2.2). Midden was encountered above a sterile, light colored silty sand.

Locus 2: This exposure was a westward extension of Trench 6. Measuring 5 m east-west by 3.5 m north-south, it was the location of Unit 3 and its extension designated as Unit 3 E.

Trench 7: A trench was excavated approximately 4.0 m west of the east water channel, about 40 m east of Trench 6. The objective was to confirm the lack of midden reported in the 1980b posthole test, in the area of Line D, Station 9 (Figure 2.2). The results were negative, with only sand and silt revealed in the profiles and spoil dirt.

Trench 8: This trench was located just east of the middle of the "peninsula" area, approximately 12 m west of Trench 7 and 25 m east of Trench 6, just east of Line C, around Station 9, where midden had been encountered previously (Figure 2.2). No midden was encountered at first, although isolated shell fragments were present in the silty matrix. The trench was later extended for 15.1 m west, toward Trench 6, to locate the surface interface of the midden deposit. Approximately 4 m west of the original trench, the shell content did increase, and the surface of midden was encountered 13 m west, at a depth of 1.4 m. Since the west end of the trench was close to the location of Burials 1 and 2, it was decided not to intrude into the midden.

Trench 9: The trench was approximately 35 m north of Trench 6 to examine an area where no midden was encountered in the 1980b test program, in the vicinity of Line C, Stations 10 and 11. The cut exposed sparse shell remains visible in a grayish-brown clay lens. The trench was later extended 7.5 m south, toward Trench 6, to locate the surface interface of the midden deposit.

Trench 10: Another trench was located approximately 40 m north of Trench 9 to test an area where no midden was found in the 1980b posthole test program, between Lines B and C, and Stations 12 and 13 (Figure 2.2). The exposure confirmed the absence of cultural remains.

Trench 11: Located approximately 20 m southeast of Trench 5, Locus 3, and just east of Line C and Station 7, the purpose of Trench 11 was to test an area where midden was reported previously (Figure 2.2). A few pockets of mixed gravel and midden (20 cm in diameter) were observed but no established culture bearing stratum.

Trench 12: Approximately 20 m south of Trench 11, the trench was positioned to examine an area of midden reported east of Line C, at about Station 6 (Figure 2.2). Within the first three meters at the east end of the trench, a brown mottled, patchy clay shell midden was observed at a depth of 1.5 m, approximately 20 m south of Trench 11. It was 0.5 m thick, below a smokey gray sand lens which continued west about 6 m, where a slightly more defined midden lens was encountered at about 1.4 m deep. A stratum of the gray sand, about 2 m wide and approximately 1.0 m deep, was encountered about midway in the trench (probably an old stream bed), and the trench immediately began to fill with water.

Trench 13: This trench was excavated about 35 m east of Trench 7, across the east water channel on the east bank of Calleguas Creek. The location was close to Line E, Station 10, where a thin, small discontinuous lens of midden (1/2" to 2" thick and approximately 3' x 4 1/2' in area) was uncovered within 1-2' of the prevailing ground surface during the December, 1980, VCFCO silt removal operation. No midden or shell remains were encountered at this time, only lenses of silt and sand.

Trench 14: Another exposure was provided approximately 90 m south-southeast of Trench 13, within two meters of the east water channel on the east bank. No midden was reported in the immediate area during the 1980b posthole test, although some sparse shellfish remains were recovered in a mottled

brown silty clay lens 0.49-0.59 m below ground surface in Posthole E6, slightly north of this location. No midden or shellfish remains were observed in the silty and sandy deposits.

Trench 15: A trench was placed approximately 110 m southwest of Trench 14, about 4 m east of the east water channel. Water began seeping rapidly into the trench through the thick gray sand lens beginning at about 1.2 m deep, where some sparse shellfish remains were observed. The side walls showed alternation between silt and sand deposits.

Trench 16: The east end of this trench was perpendicular to the east levee, approximately 95 m south of Trench 14 and 45 m east of Trench 15. It was located in an area around Line D, Station 3, where a thin, discontinuous, patchy shell midden was recorded on the surface in 1980 (Figure 2.2). No shell or other evidence of midden was visible on the surface in 1985, and only a single fragment of isolated shell was noted at a depth of 1.0 m, on top of a lens of brown clay.

Trench 17: The trench was located 25 m east of the west channel and five meters south of where the main channel crosses from the west levee to the east levee, to assess the discontinuous intact midden deposits reported in 1980 (Figure 2.2). A sand and gravel matrix (40 cm thick) with sparse remains of shell was encountered at 1.3 m, below a stratum of sand and silt. Below the shell horizon was an unknown depth of sterile clay.

Trench 18: The second in a series of three trenches designed to assess the possibility of discontinuous midden deposits, this trench was 20 m south of Trench 17. A gravel, sand, and shell stratum (40 cm thick) was found 1.5 m deep under a silty sand lens. Below the shell bearing lens was a stratum of clay.

Trench 19: The last trench in the series was 20 m south of Trench 18. A gravel and shell lens found at 1.6 m depth was 40 cm thick. Similar to the profile of the previous two trenches, the shell bearing matrix was below a lens of silt and sand, and directly above the clay deposit.

Table 2.1

Description of Trenches

(measurements in m)					
Trench	Orientation	Length	Width	Depth	Shell Depth
1	E-W	10.0	0.6	2.4	1.8 - 2.15
2	E-W	3.2	0.6	2.2	1.2 - 1.7
3	N-S	2.9	0.6	2.0	1.3 - 1.46
4	N-S	3.8	0.6	2.0	1.2 - 1.4
5	N-S	2.4	0.6	1.9	1.2 - 1.4
6	N-S	2.6	0.6	2.0	0.65 - 1.0
7	E-W	3.4	0.6	2.0	None
8	E-W	18.4	0.6	2.0	1.4 - ?
9	N-S	11.2	0.6	2.0	0.8 - 1.0
10	N-S	3.4	0.6	1.8	None
11	E-W	4.2	0.6	1.9	Pockets
12	E-W	14.6	0.6	2.5	1.5 - 2.0
13	E-W	3.1	0.6	2.4	None
14	E-W	3.2	0.6	2.4	None
15	E-W	3.4	0.6	1.9	1.2 - ?
16	E-W	3.2	0.6	2.3	None
17	N-S	3.0	0.6	2.0	1.3 - 1.7
18	N-S	3.0	0.6	2.1	1.5 - 1.4
19	N-S	3.0	0.6	2.3	1.6 - 2.0

Total Volume = 131 cubic meters

## Unit Excavation

Six 1 x 1 m units and one 1 x 0.5 m unit, oriented to Magnetic North, were completed during the archaeological test program. The placement of the units (Figure 2.1) was subjectively designed to examine as many different areas of the site as possible in order to maximize the probability that the various sets of primary data sought would be represented. The desired samples were those which would be useful in addressing questions related to chronology, site complexity, stratigraphy, depth, technology, subsistence practices, activity areas, and integrity of the deposit. Units were arbitrarily labeled in numerical sequence according to locus designation (e.g., Locus 1, Unit 1). The northwest corner of each unit was designated as unit datum, and line levels were extended from these points for depth measurements.

The controlled excavation of the units was accomplished by hand methods. Trowels were used to loosen the soil, shovels and/or dust pans were used to remove the earth into either buckets or wheelbarrows, and geopicks were occasionally used to loosen the often very moist and compact clay matrices. Either arbitrary 10 cm or natural stratigraphic levels were utilized as circumstances prompted. Each unit was begun in the arbitrary increments, and Unit 1 was continued in this method to facilitate comparisons of species and densities. The other units shifted to stratigraphic levels when there was evidence suggesting cultural or depositional change. If the lens was less than 10 cm, it was removed according to its thickness. If the stratum was greater than 10 cm, one or more 10 cm increments would be excavated, and the lowest level would be determined by the natural stratigraphy.

All excavated materials were transported by bucket or wheelbarrow to the wet screening apparatus located on the bank of the west water channel. The soils were then washed through 1/8" screen mesh, using water from the west channel raised by two



gasoline powered pumps. The washed residue was air dried in 1/8" screen mesh drying racks. The wet screening of the materials was critical for data retrieval since the cultural strata had a very high clay content, and were usually moist or wet from ground water seepage. The wet screening operation was initially located on the eastern bluff of the west bank, during the excavation of Units 1 and 2, and was later moved across the channel to process the materials from the last four units.

Level record forms were completed for each level, although not all artifacts and ecofact densities could be recognized by the excavator because of the extremely wet and cohesive nature of the mud which tended to engulf, particularly, the smaller objects. However, particular attention was paid to soil changes, disturbance factors, and natural or cultural features that were observed at each level. These phenomena were all mapped, described, and photographed. In the case of features, such as concentrations of fire affected rocks, these were mapped, photographed, quantified (weighed and counted according to type), and described. If unusually dense concentrations of shell were encountered, these were recorded, recovered, and labeled separately for further processing. Potential ground stone artifacts were wrapped in newspaper, bagged without washing, labeled, and removed promptly from the field for palynological analysis, as directed by the consultant. Charcoal concentrations were recovered on sight, wrapped in foil, bagged and labeled, and delivered to the laboratory for possible use as radiocarbon samples.

Column samples (10 x 10 x 10 cm, or an equivalent volume by natural stratigraphy) were excavated from the most representative walls for micro-analysis, and separate soil samples were collected for chemical studies. In units where thick sterile lenses separated the midden strata, the former were not sampled for micro-analysis, but were recovered for soil chemistry. Profiles and Munsell color determinations were recorded for the

most representative wall, and additional walls were also profiled if different stratigraphy or disturbances were evident. Problems were encountered with the profiling of Units 1 and 2, in addition to the lower levels of the trenches, due to rapid ground water seepage.

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Table 2.2  
Unit Levels, Depth, and Volume

Level	Unit						
	1	2	3	3E*	4	5	6
1	0.1	0.090	0.100	0.125	0.100	0.100	0.030
2	0.1	0.100	0.010	0.05A	0.100	0.130	0.025
3	0.1	0.103	0.100	0.05B	0.050	0.050	0.100
4	0.1	0.103	0.100		0.020	0.022	0.080
5	0.1	0.103	0.075		0.010		0.020
6	0.1	0.090	0.175		0.010		
7	0.1	0.100	0.132		0.040		
8	0.1	0.100	0.100		0.050		
9	0.1	0.100	0.100		0.030		
10	0.1	0.100	0.025		0.100		
11	0.1		0.025		0.102		
12+	<u>0.3</u>	—	—	—	—	—	—
Total							
Volume	1.4	0.989	1.042	0.225	0.612	0.302	0.255
(m <sup>3</sup> )							
Maximum							
Depth	1.3	1.15	1.05	0.65	0.70	0.40	0.43

\* Unit was 1 x 0.5 m; all others 1 x 1 m

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Unit excavation was terminated after encountering the underlying sterile, light colored, silty sand which occurred consistently below the compact, darker, clayey cultural deposits. In all cases, the sterile stratum was first verified by cross-checking with the adjacent trenches and shallow trowel probes, and finally, by augering from at least 65 cm to 1 m below the deepest unit floor, depending on the ground water level which sometimes hampered recovery of the deeper samples. The only exception to this procedure was Unit 1, which is described in the following section.

Excavation conditions and even wet screening were often difficult due to logistical problems of area, need to cross flowing streams, the high clay content of many of the various lenses, and the ground water seepage. The total volume excavated from the controlled units, washed, and sorted amounted to 4.83 m<sup>3</sup> (Table 2.2).

#### Laboratory Methods

The processing of all screened and washed residue was conducted under the direction of the principal investigator, with the greater part of the sorting, classification into materials, and identification of shell species completed in the field. Advance preparation included the formation of a labeled type collection of those molluscan species anticipated to occur and provision of forms on which to record gross midden constituents by level, e.g., stone, bone, total shell, charcoal, etc., and identified shell species by level in the control units. In the field, two sorting tables were established, with large capacity and fine scales, reference books, containers, and other supplies. On average, the principal investigator, laboratory supervisor, and two laboratory technicians were needed to keep up with the flow of excavated materials.

Two units (Unit 1 and Unit 4) were designated for maximum control after enough excavation had been accomplished to evaluate these as having adequate depth, minimum disturbance, and maximum data potential. Since the excavation, wet screening, and preliminary sorting processes were identical for all units, no information was lost by deferring this decision for the first few days of work. For all other units, the washed residue was sorted into categories of bone, burned and unburned stone, charcoal, shell, otoliths, pigments, flakes, and artifacts, and each constituent weighed, counted, or both. For Units 1 and 4, these steps were augmented by the identification of all shell. After completion of the field work, all bone was further separated into large and small land mammal, sea mammal, teleost fish, elasmobranch, bird, reptile, and human classes (Appendix 8).

As part of the effort to recover pollen, objects interpreted during excavation as possible ground stone artifacts were removed from context along with adherent dirt or mud, overwrapped and sealed, and transported promptly off the site without washing. As directed by the palynological consultant, soil was removed from the stones under a vented hood and surfaces then washed with distilled water under sterile procedures. After they were cleaned, the rocks proved questionable as manos, but the four samples thus recovered were submitted to Dr. Schoenwetter for analysis along with other soil samples (Appendix 5).

The paper catalogue was prepared on three-part, carbonless forms so that copies of relevant pages could be furnished to the consultants with interest in various parts of the collection. Like items, such as beads, were listed sequentially by unit and level for ease of reference and data entry. Each bead was numbered and tagged separately so that they could be handled or regrouped during analysis; they constitute the greatest bulk of the catalogue. Other artifacts were also catalogued individually. The flakes were batched and given a single entry number for each level of each unit, with a count, weight, and

identification of lithic raw material. Ecofacts were not catalogued, but have been bagged with full provenience. Significant data have been entered into dBase III spread sheets.

### 3. RESULTS OF FIELD WORK

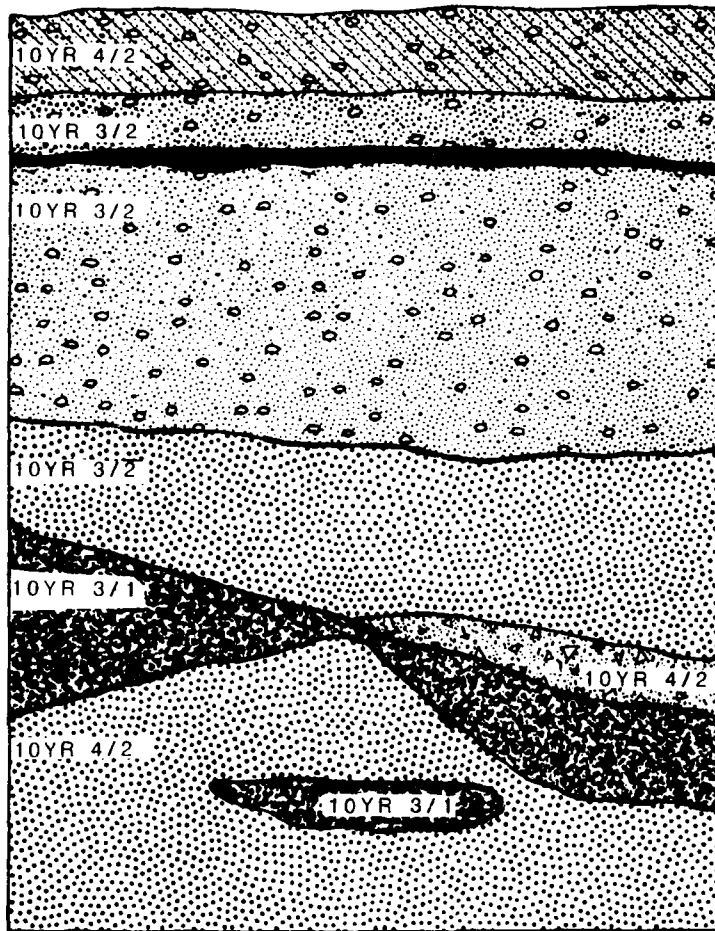
#### Description of the Units

Unit 1 (Locus 1): Unit 1 was originally situated 3.5 m west of its ultimate location; however, due to an extensive clay overburden (95 cm as detected by auger), the first attempt was abandoned. Apparently the backhoe had not removed enough overburden from the area west of the test trench. When the new eastern location for the unit was augered to detect midden surface, the top of the deposit was encountered about 30 cm below the cleared ground surface. The overburden was shoveled off to within several cm of the cultural stratum. Unit datum was 10 cm above the beginning of the cultural deposit and excavation conducted in arbitrary 10 cm increments. The unit took five working days to complete. The soil became extremely wet below 30 cm, there was standing water below 40 cm, and after reaching 70 cm, the unit would fill to the ground surface overnight and require pumping before work could resume.

Level 1 (0-10 cm) consisted of a dark gray silty clay shell midden that yielded very sparse materials, many immature sized shellfish, and a large bird talon. The culture bearing stratum continued a couple of centimeters into the next level (Figure 3. 1), where the soil changed to a dark brown, fairly sterile clay. Excavation continued, with normal screening of the entire level, until the 40-50 cm level. It was then decided to wet screen only the NW quadrant, for control, until a lower midden stratum was encountered which occurred at 60 cm. Excavation by trowel continued through the 40-50 cm and 50-60 cm levels in order to maintain control on these two levels. A distinct interface between the clay and midden occurred between 62-65 cm in depth, and screening was resumed. In the 90-100 cm level, a much darker midden was encountered in the northeast quadrant which continued past 100 cm, in contrast to the sterile clay in the remainder of the unit. The NE corner material was screened separately as 90-100, since it was suspected that this material might represent

# EAST WALL

0



130 cm

- |   |   |
|---|---|
|  Clay with shell |  Silty clay midden |
|  Clay            |  Friable midden    |
|  Loam 10YR 2/1   |  Sand              |

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Figure 3.1

UNIT 1: SOIL PROFILE

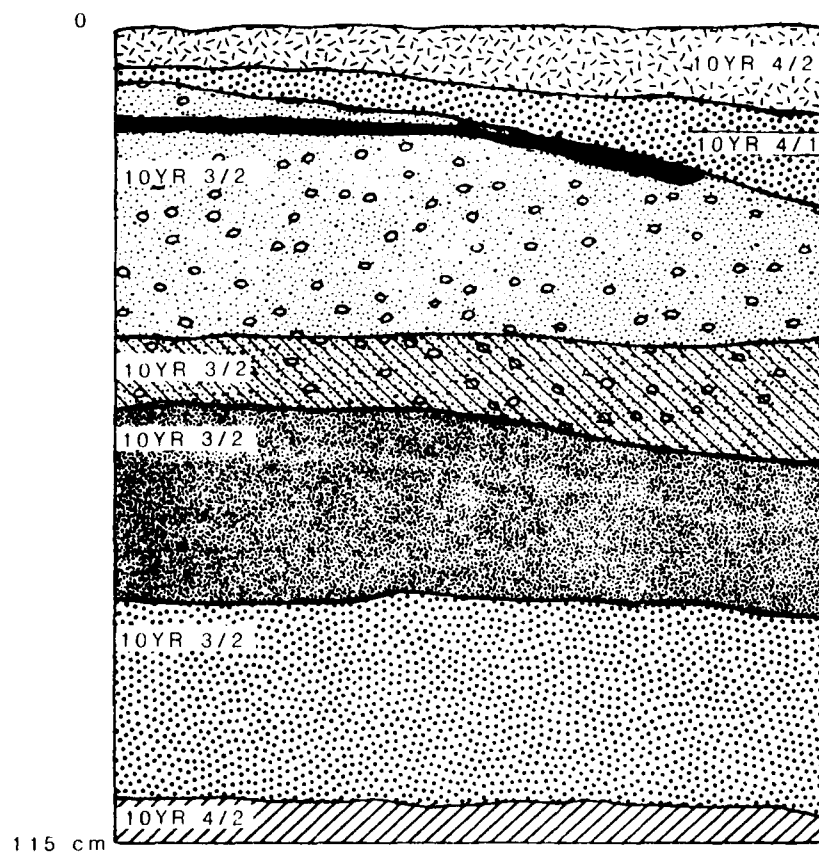
a different activity. In the 100-110 cm level, a 3-12 cm lens was encountered below the sterile, although in the SE corner the midden continued into the next level. This level sloped down to the west and southwest. At 110 cm the floor was sterile, except for the NE corner where the midden continued. The overlaying sterile lens, lower midden, and NE corner midden were screened separately.








Below 110 cm, the ground water seeped in so rapidly that the floor of the unit was no longer visible despite bailing efforts and the use of a small foot pump and wooden boards for a working platform. Just the weight and movement of the excavator compromised the integrity of the deposit (water filled in to about 25 cm). The excavator made hand probes (since the auger was useless under water) and described the following conditions: NW corner, 120-165 cm - silty clay with no shell; NE corner, 120-150 cm - pocket of sand adjacent to silty clay with no shell; SW corner, 120-150 cm - some shell in silty clay; SE corner, 120-150 cm - shell to about 150 cm, with only silty clay below. Excavation had to be discontinued due to the rapidly rising water, unavoidable effects on the integrity of the deposit, and caving in of the lower side walls.

Unit 2 (Locus 1): Unit 2 was originally situated 3.0 m west of its eventual location, but the depth of the overburden (greater than 90 cm) caused the first attempt to be abandoned, as in the case of Unit 1, and it was moved east. About 25 cm of overburden was shoveled out before the unit was staked. An additional 6-14 cm of sterile overburden was removed to expose the surface of the first cultural stratum. The excavation proceeded in 10 cm arbitrary increments from the top of the sloping (to the SW) midden (Figure 3.2). The unit was terminated in sterile silt at 1.0 m. Elapsed working time of five days was again slow because of adhesive mud and rising water.



# SOUTH WALL



- |   |  |
|---|--|
|  Silt              |  Clay with shell  |
|  Silty clay midden |  Indurated midden |
|  Loam 10YR 2/1     |  Sterile          |
|  Clay              |  |

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**Figure 3.2**

UNIT 2: SOIL PROFILE

A thin, tapering lens of midden was encountered only in the SW quadrant of the unit in the 0-10 cm level. The midden sloped down to the SW, where it was thickest, 15 cm. To the east and north, it tapered to about 1-2 cm before it disappeared into the sterile clay. The entire level was wet screened. The 10-20 cm level was also wet screened which proved to be an exceedingly difficult, time-consuming process that was fruitless in terms of recovering cultural materials. When the damp sterile clay was observed to continue, and water already seeping into the unit, the excavator was instructed to shovel out the stratum carefully without screening until another cultural deposit was encountered. The clay between 20-50 cm was thus removed with only eye retrieval. The soil then changed to a siltier clay shell-bearing deposit, and controlled excavation with wet screening resumed. More of the shells in this level (50-60 cm) were whole, rather than fractured, and many of the pelecypods still had both valves connected.

A concentration of 12 thermally affected cobble-sized rocks, along with two ribs from a large mammal, one large fish bone, and a possible ground stone fragment was encountered in the 60-70 cm level, which was already covered by water. This was labeled and fully recorded as Feature 1. Another concentration of thermally affected rocks was encountered in the following 70-80 cm level. The lower cluster contained 17 burned, cobble-sized rocks and one large fragment of cetacean bone, in a dense shell matrix. The upper concentration was designated Feature 1A, and the lower as Feature 1B, but they were almost certainly associated and only arbitrarily differentiated because of the poor visibility. The features and contents were mapped, recorded, photographed, screened, and weighed separately. No burned soil, accumulations of ash, or charcoal were observed, although by this level, considerable water was seeping into the unit.

Cultural materials within the dark clayey midden matrix continued to be fairly dense throughout the 80-90 cm level, which then changed to a light-colored sterile silty sand by the end of the 90-100 cm level, beginning first in the eastern portion of the unit. The provenience of materials between 80 and 100 cm may have been affected by the amount of water in the unit and possible mixing by the excavator's mere presence. The soil auger did manage to penetrate to at least 75 cm below the surface and retain its samples under the very wet conditions. The auger encountered only wet sterile silty sand, and the unit was terminated at 100 cm. After much bailing, profiles were drawn of the south and west walls, and column and soil samples were recovered from the west wall.

Unit 3 (Locus 2): Unit 3 and Unit 1, on the other side of the western channel, were the northernmost of the excavation units. The unit was discontinued in sterile silty clay at approximately 1.0 m after 11 stratigraphic levels. The work took five days to complete.

The first level consisted of a composite of sand, midden, and clay with only sand and clay in the eastern half (Figure 3.3). Level 2 was a lens of sand and clay comparable to the upper level but in the western half of the unit. Level 2 would appear to be a continuation of the eastern half of Level 1. The underlying level (3) consisted of midden and was excavated 10 cm. In the beginning of Level 4 two distinct concentrations were noted. The first consisted of a deposit of dark black organic plant matter along the eastern edge of the unit. The second concentration was an area of dense shell in the northeast corner of the unit containing a large amount of oyster shell. In Level 5 the northeast corner abruptly changed to a silty loam, apparently sterile. The remainder of the level was similar to the dense concentration in the northeast corner of the previous level. Concentrations of moon shell were found in the southwest corner, while in the midden overlaying the sterile lens there

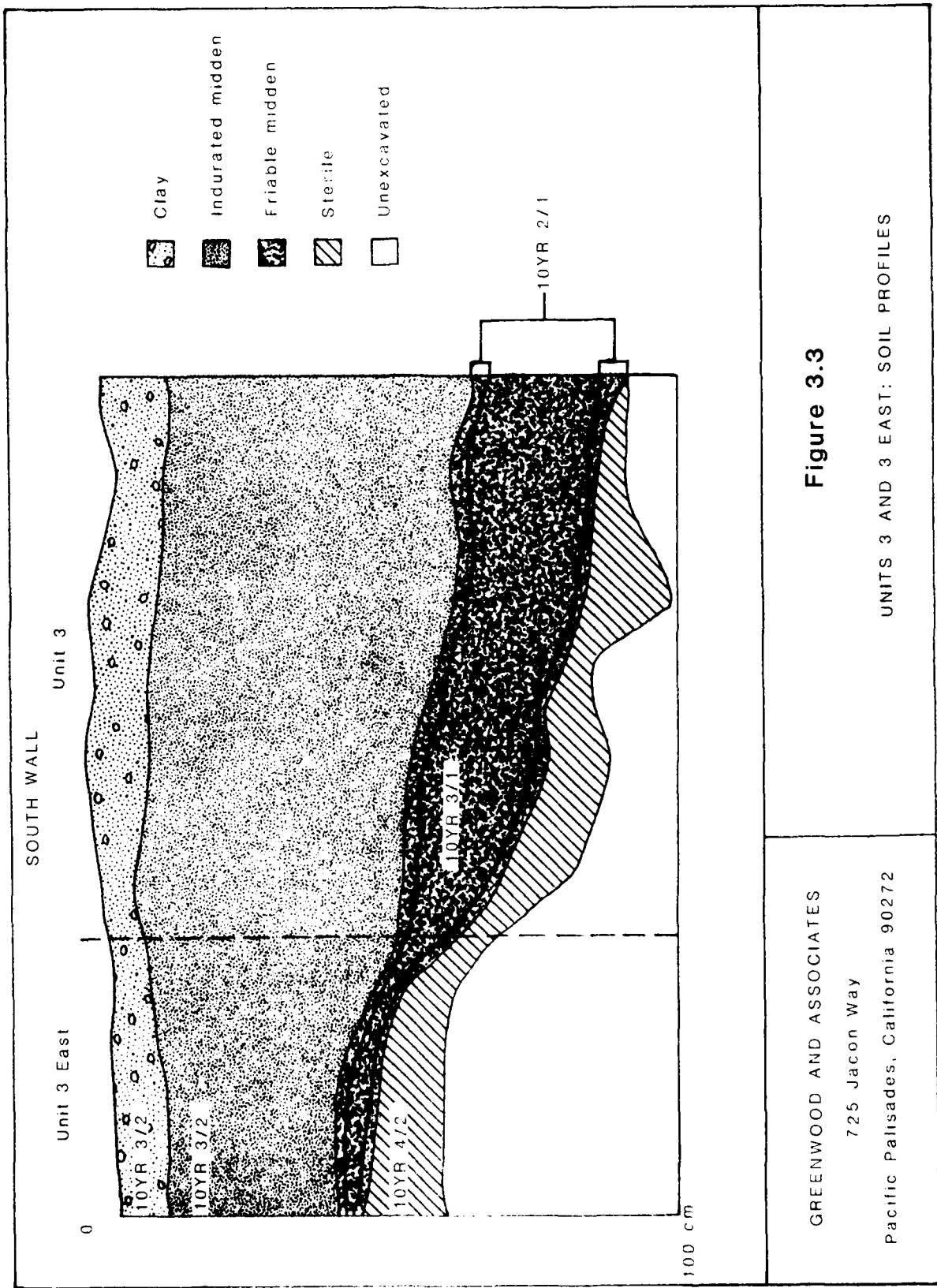


Figure 3.3

UNITS 3 AND 3 EAST: SOIL PROFILES

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were concentrations of oysters and pecten. There were pockets of the decayed plant matter throughout the unit, excluding the northeast corner.

In Level 6, while excavating 10 cm of midden, what appeared to be a human pelvis was uncovered in the eastern half of the unit. The pelvis (designated as Burial 1) appeared to be in an extension of the silty loam observed in Level 5. It was decided to differentiate materials found in the silty loam (A) and the remainder of the midden (B). In Level 7 more of the burial was uncovered in 7A, while disarticulated cranial fragments were observed in 7B near the center of the unit. A fused shale projectile point was located in the west center of unit. In 7B the soil continued to be very black with concentrations of shell, but no other organic material. The upper third of Level 8 was in the silty loam (B), and the excavation of the A lens was deferred until the context of Lens B was defined. It was at this time that a thin lens of extremely dark midden was observed immediately above the A stratum. The B lens in this level appeared to be sloping down to the southwest. With broader exposure, it became apparent that the upper torso of the burial was missing. Levels 9, 10, and 11 essentially mirror Level 8 except that the B lens continues to taper until it finally disappears at the bottom of Level 11. Exposure of the completed wall profiles made clear that the B lens was actually an intrusive pit (Figure 7) that extended downward to the west, cutting through the presumably older A horizon. This pit was designated Feature 4.

Unit 3 E (Locus 2): The gradual exposure of the pelvis and A lens in Level 8 of Unit 3 indicated that Burial 1 extended to the east. To facilitate the safe recovery of the entire burial, a 1.0 x 0.5 m unit was extended from the east wall of Unit 3 and designated Unit 3 E (Figure 3.3). By the time this unit was opened, its general stratigraphy was known by extrapolating the three strata already defined in Unit 3: a compact light density

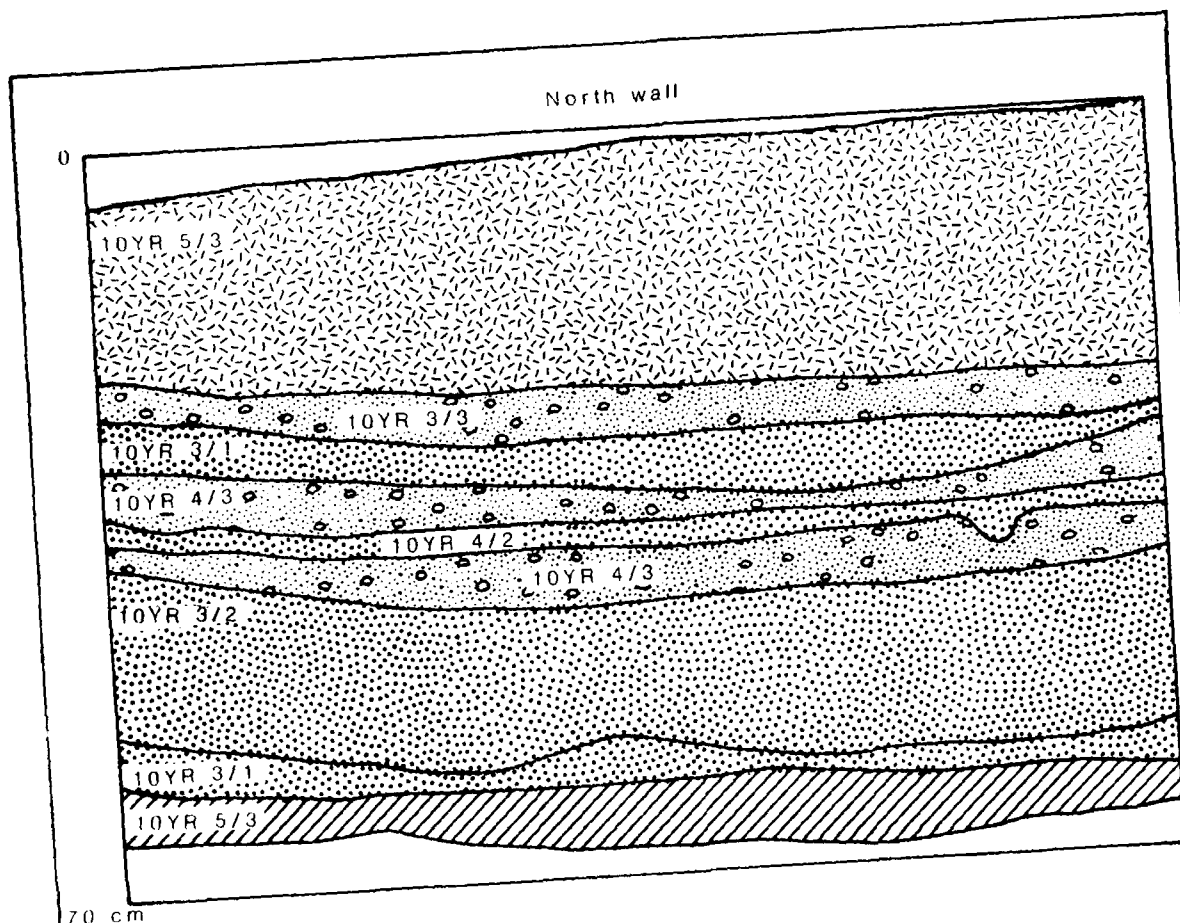
shell midden from 0 to 25 cm; a dense concentration of black midden, of varying thickness (B); and the burial matrix (Lens A). Consequently 3 E was excavated according to these stratigraphic levels. The unit took two days to complete.

During the excavation of Lens A, a second burial was encountered over the legs of Burial 1. While the matrix of Burial 2 was primarily a homogeneous silty loam, there were pockets of midden adjacent to some of the bones. The presence of rodent holes in the Unit 3 E east wall profile suggests these pockets are rodent burrows.

Unit 4 (Locus 3): Unit 4 was adjacent to Trench 5 which appeared to contain a relatively thin midden. Excavation continued to 61.2 cm before encountering sterile silty sand, and took five working days to complete because of the complicated stratigraphy.

In contrast to the trench profile, the unit was found to demonstrate a very complex sequence of alternating thin lenses of sterile soil and midden, the interpretation further complicated by rather extensive rodent disturbance that continued down to the 60 cm level (Figures 3.4, 3.7). Of the 11 levels completed, the first two and last two (10 and 11) levels were excavated in arbitrary 10 cm increments, and the intermediary seven were dug according to the natural stratigraphy.

The first two levels consisted of a silty sand overburden that contained some shell and charcoal, possibly a result of redeposition, in addition to rodent burrows that were filled with a dark shell midden. Approximately the upper 70% of Level 3 was a mottled silty sand, disturbed by rodent burrows, whereas the lower 30% consisted of a thin sterile clay lens. A small pocket of shell midden was beginning to appear in the NW corner of the second level and continued into the third level. In Level 4, the midden expanded into a thin lens (approximately 3 cm) throughout



-  Silt
-  Clay
-  Silty clay midden
-  Sterile
-  Unexcavated

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**Figure 3.4**

UNIT 4: SOIL PROFILE

the northern half of the unit; the southern half split (by a peel line) into two midden lenses separated by a very thin sterile clay lens, and the lower one was designated Level 5. Apparently the separation actually occurred across the entire level, based on the profile, but was not apparent in the northern half due to rodent disturbance. A concentration of charcoal, approximately 5 x 5 x 5 cm, was encountered in the center of the unit in Level 4, and was removed and bagged as a potential radiocarbon sample. The southern half of Level 5 contained a thin midden lens, whereas the northern half had already been taken down to sterile clay. The southern half seemed to contain a predominance of large and small fish remains, many of which were articulated near the base of this level. This occurrence was labeled Feature 2 and fully recorded, with the articulated remains bagged separately.

Level 6 was a sterile clay lens variously 4-10 cm thick, that was peeled off from the underlying midden and discarded except for the clay in the south half which was screened along with Level 7 since it contained some cultural materials resulting from a less distinct peel. Level 7 was a 1-2 cm thick midden lens, over a 3-6 cm (thicker in the northern half) stratum of sterile clay. The peel line was encountered beneath the clay, so both the existing upper midden and lower clay were screened together. This level also seemed to contain a predominance of fish remains over shellfish, along with relatively numerous large mammal bones. The upper portion of Level 8 was blacker than previously excavated midden lenses, with a high proportion of whole mussel shells and large mammal bones, and less fish remains. The very dark midden graded into a lighter gray brown, siltier, and somewhat mottled midden with no distinct break.

When the upper lens (Level 7) was removed, a conical depression, 20 cm in diameter and 8 cm deep, was revealed in the lower midden (Level 8). The fill contained more charcoal flecks relative to the rest of the unit, and a bone artifact was found

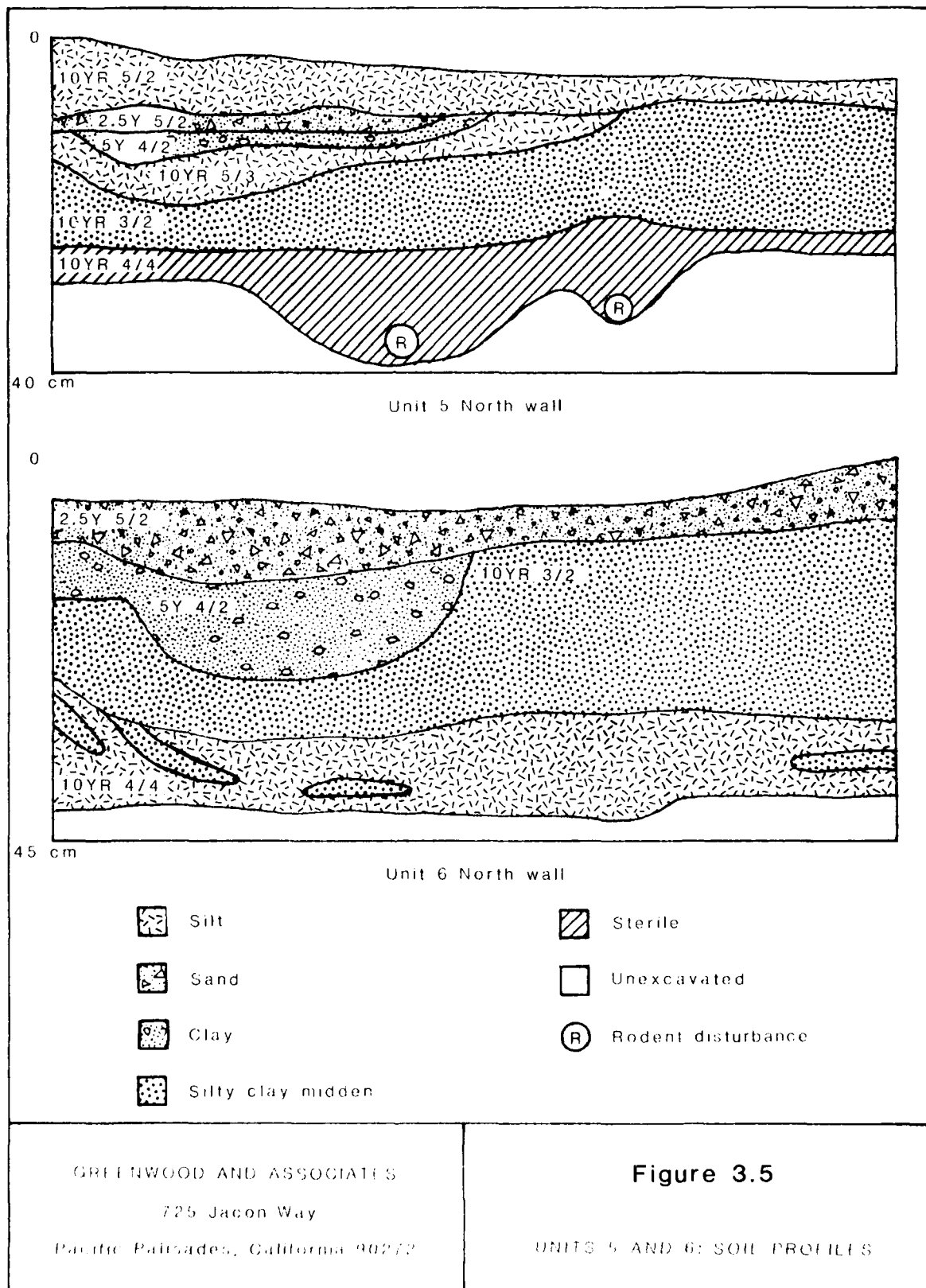


in the depression (Figure 3.6). Immediately to the west were two burned sandstone rocks. This phenomenon was labeled and recorded as Feature 3. In the next level, the depression was bisected, but no additional information was revealed.

The lowest two lighter and mottled strata (Levels 10 and 11) were excavated in arbitrary 10 cm increments since no discernible lensing or peel lines could be detected. If there was any disconformity present, the accumulation of water, particularly from the west wall and southern corner, obscured it. A large fragment of a cetacean rib was encountered in the ninth level, extending slightly into the sterile zone of the SW corner. It was wrapped and bagged separately as a potential radiocarbon sample. An increase in clam shells, visibly stained an orange-red color, was observed in the tenth level. At the base of Level 10, sterile silty sand was encountered across the entire floor, sloping to the southeast. The unit was terminated after coring through 80 cm of continuous sterile silty sand. The north and east walls of the unit were profiled, and column and soil samples were extracted from the east wall.

Unit 5 (Locus 4): In Unit 5, sterile soil was unevenly encountered between 14 and 38 cm below surface, and the unit was completed in two working days. The deposit comprised a single very uneven lens of midden which was excavated according to natural stratigraphy (Figure 3.5). Extensive rodent disturbance was noted throughout the excavation.

Level 1 consisted of a semi-mottled grayish silty sand that contained some sparse shellfish remains. Below this level was a very irregular light brown silty sand lens which also contained some sparse shellfish. Scouring, redeposition, and rodent tunneling seemed to have adversely affected the upper deposit. Level 3 was the irregular midden lens that varied from approximately 3 cm to about 15 cm in thickness and was discontinuous in the SE quadrant of the unit. Level 4 represents



the interface of midden material from Level 3 with the sterile silty clay below. Seven depressions of an uncertain nature and two rodent tunnels were encountered, containing mottled midden materials to various depths until sterile silt was encountered. The sterile silt was augered to a depth of 1.0 m and was found to be continuous.

Unit 6 (Locus 5): The final unit, situated near the very southern end of the peninsula, contained only a thin midden lens of approximately 15 cm. This area was sampled because Trench 4 revealed an array and distribution of materials which appeared to contrast with the other exposures. The shellfish remains were more often whole, more apt to retain color and periostracum, and stained a bright orange-red color. Further, the midden appeared to be somewhat siltier and to contain streaks of burned soil and relatively large amounts of bone and charcoal. Sterile was encountered at a maximum depth of 40 cm below ground surface. Completion of the unit took two days of work.

Locus 5 was an eastward extension of Trench 4. However, as the locus was being cleared of overburden, it was found that the midden level was lower to the east than in the trench, with much of the overlying material being a grayish sand. The indication from both the unit and broader locus exposure was that a stream channel had once cut its way through the midden lens (north to south) and consequently redeposited cultural materials in the form of a stratum of shell mixed with cobbles and gravel.

Level 1 consisted of an uneven overburden of gray sand and pebbles, with midden being encountered in different areas between 2-7 cm in depth (Figure 3.5). Many of the organic materials recovered in the sand were reasonably intact and in good state of preservation, suggesting that the stream disturbance was a relatively recent phenomenon. This material was screened since it contained cultural materials. Level 2 was an eroded (scoured) midden lens that was further disturbed by rodent activity in both

the NW and NE corners. The scoured midden continued in Level 3, although it seemed to contain fewer cultural materials, and it was also removed in an uneven 10 cm increment. Level 4 was another 10 cm increment of the continuing uneven and scoured midden, with sterile appearing in the higher portion of the northern half of the unit. Level 5 comprised the remaining midden which was located in uneven pockets (perhaps from rodent activity) to a maximum depth of 40 cm. However, in the sterile below the pockets were additional very thin, narrow lenses of midden, none more than 1 cm thick, which may have represented some very brief time of occupation before an inundation. The uneven sterile floor was excavated to create a flat surface which might have revealed any further possible occurrences of midden, but none was found. The unit was closed after augering to a depth of 1.0 m and encountering only a continuous deposit of light colored silty sand. Profiles were drawn of all four walls, and soil and column samples were taken from the north wall.

Table 3.1

Summary of Unit Statistics

Unit	Max. Depth	Elev. NW Corner*	Cubic M
1	1.30	1.61	1.400
2	1.15	1.66	0.998
3	1.05	2.04	1.042
3 E	0.65	2.04	0.225
4	0.70	1.83	0.612
5	0.40	1.30	0.302
6	0.43	1.30	<u>0.255</u>
Total Volume of Controlled Excavation			4.834

\* Meters above mean sea level

## Features

For the purposes of this investigation, the definition of features is that of Heizer and Graham (1967:90):

The word "feature" is ordinarily used to denote those material and visible items in or about archaeological sites which are either atypical of the general run of the deposit or not frequently encountered on the surface or in the vicinity of an aboriginal habitation.

Four such anomalies were encountered during the field work. The first feature was a cluster of fire-affected rock; the second, a group of articulated fish vertebrae; the third, a symmetrical depression in the soil with an associated bone tool; and the fourth, a pit with concentrations of ecofacts and cultural materials.

### Feature 1

Feature 1 occurred in Unit 2, Levels 7 and 8. It covered an area of one square meter with a volume of 0.2 m<sup>3</sup>. The constituents included a cluster of rocks (37), bone (3), and shell (19,530.0 g) along the south and easterly sides of the unit.

Level 7 contained 12 fire-affected rocks, four unburned rocks, two pieces of unburned bone (one large mammal and one fish vertebra), and one piece of burned large mammal bone. There were 3,530.0 g of shell in this level. In Level 8 there were 17 fire-affected rocks, four unburned rocks, and 16,000.0 g of shell. The rocks ranged in size from 5 to 25 cm in diameter with most averaging between 10 and 15 cm.

Most of the shell was in Level 8, at the base of the feature, and central to the cluster of rocks. Three of the rocks in Level 7 were directly superimposed over stones in Level 8; it is possible that additional evidence of regularity and shape was present, but the standing water, adhesive mud, and mere presence of the

excavator may have disturbed the arrangement and certainly hindered further observations.

#### Interpretation

The feature contains 96% (wt. = 48,909.2 g) of the burned rock in Unit 2 and 53% of all fire-affected rock for the site as a whole. In contrast, the feature contains 20% (34.2 g) of the charcoal for the unit, and only 2% of this material excavated. Unit 2 contained only 6% (wt. = 303.1 g) of the total recovered faunal material. It surpasses only Unit 6 (4%; wt. = 175.5 g) in total percent of bone weight. In regard to shell density, Unit 2 ranks fourth in total shell weight; however, Level 8 contains the highest amount of shell by percent of unit (52%; wt. = 16,000.0 g) with the exception of Unit 3 E, Level 2 (82%; wt. = 19,400.0 g). In summary, Feature 1 contains a large amount of fire affected rock, a great quantity of shell, and little charcoal or bone.

It is unfortunate that a clean, dry, undisturbed exposure of the rocks was impossible, but the constituents and associations imply use for the cooking of shellfish. This is based on the large amount of fire-affected rock and shell and relative lack of other faunal remains present in the unit and Levels 7 and 8. The lack of charcoal suggests that the method was not cooking over a fire but rather steaming in a bed of heated rocks. The directions for a modern clambake correspond remarkably well to the observed remains found in Feature 1:

Dig a sand pit about 1 foot deep and 3 1/2 feet across. Line it with smooth round rocks. ... Build a fire over the rock lining ... Gather and wash about 4 bushels of wet rock seaweed. Rake the embers free of the hot stones, remove them from the pit and line it with the wet seaweed. Pack the pit in layers... and cover with a wet tarp (Rombauer and Becker 1975:380).

The analogy would account for the fire-affected rocks, large quantity of shellfish remains, and the lack of charcoal. Although a pit was not found, it is possible that it was obscured by the water in the unit, or perhaps the rock and shells are refuse from a primary cooking area in the immediate vicinity.

### Feature 2

During the excavation of Unit 4, Level 5, five groups of articulated fish vertebrae were uncovered in a thin lens of midden (1 - 2 cm thick) on the top of a clay lens (Level 6). The largest of the groups contained 13 vertebrae of a single fish, 50 cm long. One vertebra near the eastern end of this skeleton had a 12 cm long spine projecting toward the north. The other four groups of vertebrae were smaller articulated units consisting of two to six vertebrae each, and were considerably smaller in overall size than the largest fish (ratio of approximately 1:3). The bones were attributed to the family Scombridae, possibly tuna or mackerel (C. Swift, personal communication 1985). These are pelagic schooling fish, and might have weighed about seven pounds. Some of the remains appeared burned.

### Interpretation

The level containing Feature 2 yielded 12% (wt. = 87.4 g) of the total bone in Unit 4, although it represented only 2% of the unit's total volume. Compared to the rest of the unit, this level is underrepresented in all other data categories, and is by far the thinnest (1 - 2 cm). The fact that the fish remains are still articulated, which is typical of filleting (Rombauer and Becker 1975:396), and are concentrated in a context which lacks average quantities of artifacts and other ecofacts suggests that this level and area were used for the preparation of fish. A similar area was described by Father Antonio de la Ascension in 1602: "I saw with my own eyes some Indian women cleaning some fish on the beach for food for themselves and their husbands and children" (Wagner 1929:237). This suggests that the preparation

of fish could have been a specialized activity; either several fish might be worked upon at a time, or the activity might have been repeated in the same place.

### Feature 3

This feature was also encountered in Unit 4, in the northwest corner of Level 8. It is a symmetrical conical depression in the soil associated with burned rocks and a bone artifact (579). The overall area is 20 cm north-south by 40 cm east-west. The soil depression is 20 cm in diameter and 8 cm deep (Figure 3.6). The bone tool, most probably part of composite fishing gear, was found in a vertical position inside the depression. Adjacent to the west side of the concavity were two fire-affected sandstone rocks. The pit itself was dug into the surface of an uncharacteristically flat and level midden stratum.

The level contains 34% (wt. = 4.0 g) of the bird bone for Unit 4, although the unit as a whole has only 8% (wt. = 11.7 g) for the entire site. The depression contained an unusual amount of charcoal flecking relative to the rest of stratum, but reference to the amount of charcoal in this level, 18% (wt. = 36.8 gm), indicates that for the level as a whole there was nothing disproportionate. In terms of comparisons between levels in this unit, Level 8 contained 47% (no. = 14) of the beads and 44% (no. = 8) of the total artifactual material (including flakes). The proportion of cultural materials is relatively high, and in combination with the same material in Level 9, would mean that 80% of the beads (no. = 10) and 88% (no. = 16) of the other cultural materials are spatially associated.

In summary, the level with Feature 3 contains relatively high amounts of bird bone and discrete concentrations of artifacts relative to the rest of the unit. The soil depression appears to be highly symmetrical, although it is not clear whether it represents the impression of a basket or small stone vessel, or was deliberately dug. In context, its presence appears to be



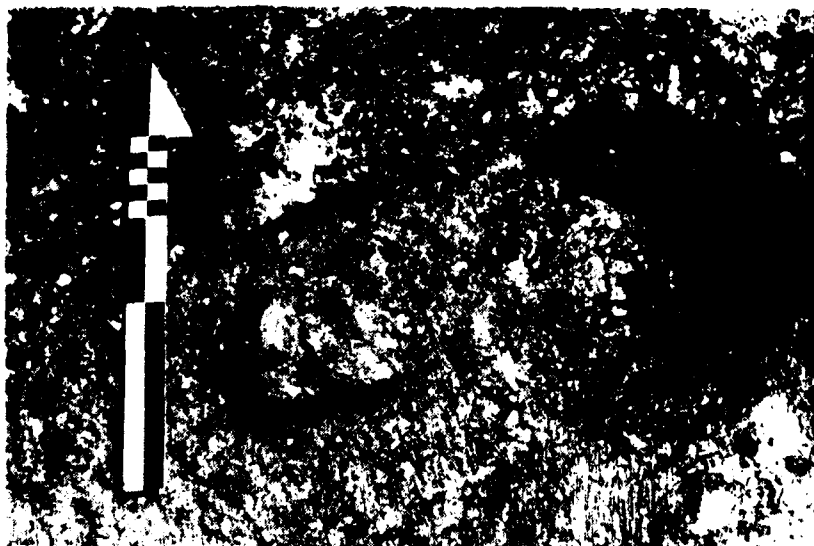


Figure 3.6  
Feature 3 in Unit 4  
(Bone artifact 579 in situ)



Figure 3.7  
Unit 4, South and West Walls

anomalous relative to the flat surface of the stratum. The position of the bone artifact within the basin appears to be purposeful.

#### Interpretation

The data do not support a definitive interpretation. It would seem that the depression and bone tool represent a purposeful activity or feature, but its nature is unknown. The depression may be a storage cache. The context of the feature, an atypically flat midden surface, and the relative abundance of beads and flakes may be indicative of a house floor or living surface. If the depression had been created for storage, it would have needed protection from the elements, e.g., rain or surface water. This might support the theory of a house floor. Alternatively, the basin may be a mold or impression of a basket which has disintegrated, or a stone vessel which was removed.

#### Feature 4

This feature occupies portions of Units 3 and 3 E. In Unit 3 the feature is between 68 to 95 cm in depth; in Unit 3 E, it occurs between 38 and 43 cm. It is a pit with three strata which are parallel, but of different thickness and composition. In profile, the feature appears to have a fairly well defined horizontal lip, steep sides down to 80 cm, and then a more gentle slope down to the base (Figure 3.3). Approximately 20% of the east side of the feature was exposed.

The upper and lower strata consist of very black greasy midden soil without significant amounts of shell or other material. The middle stratum is a relatively dense concentration of whole to slightly fragmented shellfish and a distinctly above average density of artifacts, particularly shell and glass beads. The thickness of the upper and lower strata does not vary (2 cm), while the middle lens becomes progressively thicker to the west.

### Associations

The three strata overlay Burials 1 and 2. There is no evidence that the strata are broken or otherwise disturbed. Burial 1 has been truncated at the upper edge of the pit, suggesting that the pit was intrusive to the burial and therefore post-dates it. Additionally, human cranial fragments were present in Levels 7, 8, 9, and 10. This suggests that during the prehistoric excavation or use of the feature, there may not have been knowledge that a burial was being disturbed.

Possibly related to the abandonment of the feature is the black organic plant matter found on top, which appears to be a natural matting of cattails as opposed to a woven fiber or fabric (C. Rozaire, personal communication 1985).

Within the middle stratum were concentrations of similar shellfish species (see discussion of Unit 3, this section). The clusters of similar species may have resulted from gathering forays for specific mollusks which inhabit the same environment. Presumably after consumption they would be dumped together into a refuse pit. This would account for the discrete clusters of shellfish within the feature.

### Interpretation

On the basis of the contents and sidewall profiles, the feature is interpreted as a pit used for disposal, during the later occupation of the site and after the burials. As excavated, it would have been relatively shallow, no thicker than 45 cm, unless it is deeper in the unexposed area to the west. The minimum diameter is estimated at 2.4 m with the lip contained between 0 and 30 cm in the east wall of Unit 3 E.

The presence of pockets of the same shellfish species suggests a primary deposition, while the lack of burned or clustered rock implies it is consumption, rather than cooking, refuse. The

profile is difficult to interpret. The upper and lower strata are very similar in thickness, texture, and constituents, but separated by one of the most dense concentrations of midden on the site. Whether these basal and capping lenses were deliberately created is far from clear.

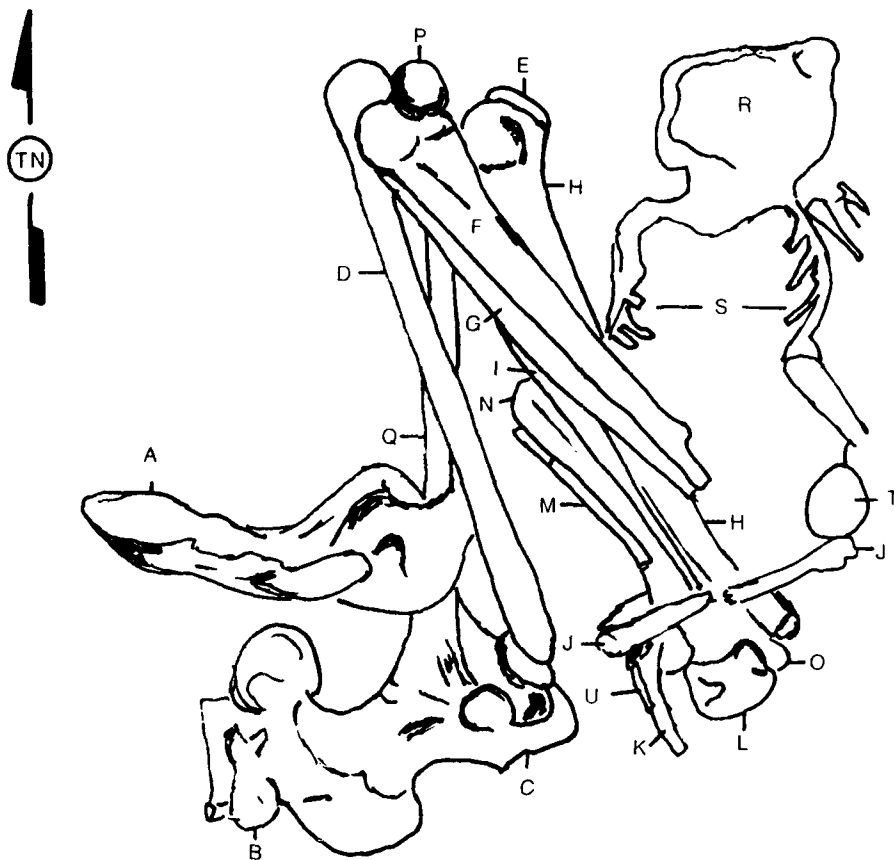
### Burials

Two burials were encountered during this excavation. Both were found together in Units 3 and 3 E with no evidence of a prepared pit or associated offerings. The remains were between 45 and 58 cm in depth, and occupied an area of 1.6 m<sup>2</sup>. The burials are interred in a silty loam (described as Lens A) generally free of cultural materials or midden. The greatest thickness (2 to 5 cm) of Lens A above the burial is along the east wall of Unit 3 E, just below the strata of Feature 4.

Both burials are described as primary interments, described by Heizer and Graham as those which:

lie in the same anatomical relationship (articulation) that they occupied during the time the individual was alive, and the presumption is that the corpse was placed in the grave so that the skeletal elements remain in essentially the same position after disappearance of the soft tissue (1967:111).

As fully described and discussed in Appendix 2, Burial 1 is an adult female interred on the left side in a flexed position (Figure 3.8). The upper part of the torso is missing, presumably cut through and displaced by Feature 4. The left sided flex suggests that the head was pointed west and the face north. Burial 2 is a juvenile of indeterminable sex with its face down, head pointed to the north. The orientation of the upper body is face down and extended, while the legs (and presumably the pelvis) are twisted to the left (west and on the right side) and flexed.



A - Right pelvis, Adult  
 B - Lumbar vertebrae, Adult  
 C - Left pelvis, Adult  
 D - Right femur, Adult  
 E - Left patella, Adult  
 F - Right tibia, Adult  
 G - Right fibula, Adult  
 H - Left tibia, Adult  
 I - Left Fibula, Adult  
 J - Left femur, Subadult

K - Left tibia, Subadult  
 L - Left calcaneus, Adult  
 M - Right fibula, Subadult  
 N - Right tibia, Subadult  
 O - Tarsals of left foot, Subadult  
 P - Right patella, Adult  
 Q - Left femur, Adult  
 R - Cranium, Subadult  
 S - Rib cage, Subadult  
 T - Left ilium, Subadult  
 U - Left fibula, Subadult

GREENWOOD AND ASSOCIATES

725 Jacon Way

Pacific Palisades, California 90272

**Figure 3.8**

PLAN OF BURIALS 1 AND 2

### Associations

The lower right leg of the adult extends over the lower left side of the juvenile's rib cage. The adult's left leg and foot are below the juvenile's left leg. The burials are clearly associated and almost certainly contemporary. There are no other defined associations. A single shell bead was found adjacent to the fifth lumbar vertebra of the adult during the cleaning process, but the association is suspect due to the presence of rodent burrows adjacent to some of the bones. An intact abalone shell was located 20 cm above the legs of the two burials. Initially thought to be associated with the individuals, it was found on removal to be linked to a thin intrusive stratum of midden.

### Midden Analysis

The primary objectives of the midden analysis were to identify and quantify the various constituents and establish the relative proportions of each variable in its horizontal and vertical distribution over the area tested. The ultimate purpose, aside from the immediate information derived, was to assess the research potential of the remains. Totals were compiled by weight, count, or both, as most appropriate, and then expressed as total per cubic meter so that the units could be compared with each other, and CA-VEN-110 as a whole compared to other sites. The conversion to volumetric standard was particularly necessary since certain units were excavated by stratigraphic levels, and there would be no other valid way to compare a level 10 cm deep with another which might be either thinner or greater. The figures and discussion which follow are based on the total residue retained in the 1/8 in screens.

Table 3.2 provides the total gross weight of some of the key midden constituents; the figures should not be used to compare the relative distribution by units, since the units differ greatly in depth and volume excavated, but the raw data indicate

the sizes of the samples which support the interpretations. Greater detail and distributions by levels are provided in Appendices 6 and 8.

Table 3.2.

Weight of Selected Midden Constituents  
(in g)

Unit	Stone		Shell	Animal	
	Burned	Unburned		Bone	Charcoal
1	28,452.3	8,666.1	108,615.4	1,216.0	729.3
2	50,709.2	543.5	30,851.0	666.0*	178.0
3	10,988.1	6,873.2	146,478.4	1,652.3	271.6
3 E	711.4	1,291.4	23,662.8	467.2	55.2
4	1,293.3	3,310.0	42,897.9	3,638.6**	208.4
5	235.6	2,947.5	21,564.6	370.2	39.6
6	<u>551.5</u>	<u>2,246.9</u>	<u>22,304.2</u>	<u>175.5</u>	<u>63.9</u>
Total	92,941.4	25,878.6	396,374.3	8,185.8	1,546.0

\* Single cetacean element = 362.9 g

\*\* Single cetacean element = 2,800.0 g

The relative frequencies of key analytical classes - ecofacts and artifact groups with adequate sample totals - can be expressed for each unit as weight or number per cubic meter, and as the percentage of the class total, e.g., % of total shell weight, found within each unit (Table 3.3). The ranking of each unit in the selected categories (Table 3.4) was derived from the volumetric analysis, since simple weights or numbers would be biased by the difference in unit depths and the levels excavated stratigraphically as opposed to those removed in arbitrary 10 cm levels. Rank 1 denotes the greatest abundance; Rank 7 signifies the least quantity among the seven units.

Table 3.3

Relative Distribution of Midden Constituents

<u>Unit</u>	<u>Animal Bone</u>			<u>Shell</u>			<u>Beads</u>			<u>Flakes</u>		
	% of	g		% of	kg		% of	No.		% of	No.	
	<u>Tot.</u>	<u>M<sup>3</sup></u>		<u>Tot.</u>	<u>M<sup>3</sup></u>		<u>No.</u>	<u>Tot.</u>	<u>M<sup>3</sup></u>	<u>No.</u>	<u>Tot.</u>	<u>M<sup>3</sup></u>
1	15	868.6		27	77.6		91	16	65	21	12	15
2	8	673.4		8	31.2		61	11	62	12	12	15
3	20	1,585.7		37	140.6		25	46	247	59	35	57
3 E	6	2,076.4		6	105.2		55	10	244	7	4	14
4	44	5,945.4		11	70.1		30	5	49	16	9	26
5	5	1,225.8		5	71.4		40	7	133	33	19	110
6	2	686.7		6	87.5		<u>29</u>	5	114	<u>23</u>	13	90
							564			171		
Site Average												
per M <sup>3</sup>		1,817.7 g			82.1 kg				117			35

Table 3.4

Rank by Unit of Midden Constituents  
 (by quantity per M<sup>3</sup>)

<u>Unit</u>	<u>Bone</u>	<u>Shell</u>	<u>Beads</u>	<u>Flakes</u>	Burned <u>Stone</u>
1	5	4	5	5	2
2	7	7	6	6	1
3	3	1	1	3	3
3 E	2	2	2	7	4
4	1	6	7	4	6
5	4	5	3	1	7
6	6	3	4	2	5



## Shell

Forty-seven molluscan species were identified. The full list and a distribution by level in Units 1 and 4 are included as Appendix 7 and Tables 3.6 and 3.7. For comparison with the array at CA-VEN-11, members of the same genus which inhabit a common habitat, e.g., the Chiones, have been grouped, and the most prevalent varieties at both sites are presented in Table 3.5.

Table 3.5

Most Abundant Shell Species at CA-VEN-110 and CA-VEN-11  
(by percentage)

Species	CA-VEN-110		CA-VEN-11*
	Unit 1	Unit 4	
<u>Chione</u> sp.	57.4	37.1	22.00
<u>Ostrea lurida</u>	8.1	13.0	20.00
<u>Tivela stultorum</u>	7.5	9.9	0.75
<u>Mytilus californianus</u>	4.6	16.8	30.50
<u>Argopecten aequisulcatus</u>	6.2	6.1	3.50
<u>Protothaca staminea</u>	5.1	6.4	10.00
<u>Saxidomus nuttallii</u>	3.9	5.2	3.00
<u>Macoma</u> sp.	2.0	3.9	0.10
<u>Tagelus californianus</u>	1.5	0.7	0.68
<u>Cerithidia californica</u>	1.8	T	-
<u>Tellina</u> sp.	2.0	T	T

T = trace, less than 0.05%

- = absent

\* Resnick 1980:131

Comparisons must be approached with caution since the data from CA-VEN-11 were derived from 1000 g gross bulk samples, of which the total shell remains might comprise as little as 12.6 g (Resnick 1980:Table 6). However, subjectively as well as statistically, Resnick concluded that Mytilus was overwhelmingly

preferred at Muwu, and everywhere else that this species was available (1980:69-70). This was clearly not the case at CA-VEN-110, where a larger sample was sorted and the entire sample had been recovered from 1/8 in mesh. It is tempting to ascribe the apparent difference in preference to the greater proximity of Muwu to the open coast, where the Mytilus might have been gathered, although the other favored species from CA-VEN-11 would share the same lagoonal or mud flat habitat as those harvested at CA-VEN-110, and were presumably collected from the same location.

A site with a species distribution more parallel to that of CA-VEN-110 is CA-SBA-60, comparably situated beside the former Goleta slough, within one mile of the coastal waters. There, too, Chione accounted for more than half of the total shell, with lesser - but regular - reliance on Ostrea, Tivela, Protothaca, Macoma, and Saxidomus, and trace presence of such lagoon edge species as Cerithidia (Greenwood 1961:409-422). Examination of 69 samples from the Goleta site demonstrated that 95.9% of the shellfish consumed were mud-dwelling species which could have been easily obtained in the slough (Ibid.:419). At both sites, Mytilus and Haliotis were less abundant than at Muwu. Since all three were occupied at approximately the same time, the difference is most likely to be a factor of distance from the outer coast whereby the return for energy expended in gathering shellfish is maximized by relying primarily on those species most efficiently harvested. Unfortunately, no data are available on the molluscan remains from Simo'mo; if this proposition is valid, comparison might demonstrate even lower proportions of Mytilus and other open water species because of the slightly greater distance from the outer coast.

As part of the midden analysis, the shell species identified in Units 1 and 4 were compared to determine if any patterns could be discerned. The percentage of the 11 most abundant shellfish types was computed on a level by level basis (Tables 3.6 and 3.7).

Table 3.6

Predominant Shellfish Species in Unit 1 by Level and Percent

Level	Chione	Argo- pecten	Tivela	Ostrea	Proto- theca	Mytilus	Tagelus	Ceri- thidia	Saxi- domus	Macoma	Tellina
1	81	1	0	0	4	0	0	6	0	0	6
2	100	0	0	0	0	0	0	0	0	0	0
6	100	0	0	0	0	0	0	0	0	0	0
7	65	8	11	6	0	2	0	2	4	0	0
8	41	16	13	9	5	1	6	5	1	1	0
9	70	6	8	5	1	3	1	3	2	1	0
10	37	9	9	8	10	7	4	1	4	8	0
11	20	7	9	21	12	8	3	1	14	4	0
12	35	7	17	15	9	10	1	0	5	0	0
13	25	8	8	17	10	15	0	0	8	6	0

Table 3.7

Predominant Shellfish Species in Unit 4 by Level and Percent

Level	Chione	Argo- pecten	Tivela	Ostrea	Proto- theca	Mytilus	Tagelus	Ceri- thidia	Saxi- domus	Macoma	Tellina
1	23	6	8	11	20	13	1	0	3	5	0
2	13	6	5	21	18	17	3	0	10	6	0
3	27	9	2	33	1	19	0	1	5	2	0
4	40	7	7	22	6	10	2	0	4	2	0
5	19	11	0	0	0	70	0	0	0	0	0
7	49	0	17	14	0	0	0	0	6	12	0
8	32	6	17	7	11	15	0	0	5	6	0
9	64	7	15	4	0	4	0	0	3	2	0

The shell types were then ranked to four places in the order of their abundance (Tables 3.8 and 3.9). Since the rankings are relative, caution must be exercised in making interpretations without reference to the actual weight of the samples, and further analysis is needed to test whether the observations are statistically significant. Levels which were sterile or contained only very small amounts of shell are not included.

Table 3.8  
Ranking of Shellfish in Unit 1 by Level

Rank				
<u>Level</u>	1	2	3	4
1	Chione	Cerithidia	Tellina	Protothaca
2	Chione	-	-	-
6	Chione	-	-	-
7	Chione	Tivela	Argopecten	Ostrea
8	Chione	Argopecten	Tivela	Ostrea
9	Chione	Tivela	Argopecten	Ostrea
10	Chione	Protothaca	Argopecten	Tivela
11	Ostrea	Chione	Saxidomus	Protothaca
12	Chione	Tivela	Ostrea	Mytilus
13*	Chione	Ostrea	Mytilus	Protothaca

\* = Pocket of shell

Table 3.9  
Ranking of Shellfish in Unit 4 by Level

Rank				
<u>Level</u>	1	2	3	4
1	Chione	Protothaca	Mytilus	Saxidomus
2	Ostrea	Protothaca	Mytilus	Chione
3	Ostrea	Chione	Mytilus	Argopecten
4	Chione	Ostrea	Mytilus	Argopecten
5	Mytilus	Chione	Argopecten	-
7	Chione	Tivela	Ostrea	Macoma
8	Chione	Tivela	Mytilus	Protothaca
9	Chione	Tivela	Argopecten	Ostrea

Only the four most abundant species are compared since those less prevalent occur in only very low percentages and do not constitute significant food sources. In both units, members of the Chione family represent the dominant shellfish, followed by Tivela. For the most part, the distribution of the four most common species is similar between the two units, except that more Mytilus is present in Unit 4.

On a level to level comparison of each unit, there appear to be greater differences. In Unit 1 from Level 1 to 10, there was a greater reliance on Tivela and Argopecten, followed by Ostrea. From Level 11 down, Ostrea occurs in greater numbers. In Unit 4 differences are more apparent. Chione, Ostrea, Protothaca, and Mytilus are dominant in the first four levels, with an abrupt change to Chione and Tivela from Level 7 down.

It would appear from these data that there have been some changes in the secondary shellfish groups, although the primary shellfish has essentially remained Chione. The presence of more Mytilus in the upper levels of Unit 4 may be an indication of a shift in collecting habitat during the Late Period. Studies of diversity and equitability may yield additional information about the number of species utilized at the site, and the degree of dependence on the various individual species.

#### Bone

All bone was differentiated into gross categories by unit and level (Appendix 9). For the purposes of this investigation, particular attention was paid to the fish bone for greater insight into the subsistence pattern and comparison with conclusions drawn from CA-VEN-11. Skeletal material was sorted, as far as possible, into teleost or elasmobranch classes, and comparative density and rank order computed for the units (Table 3.10).

Table 3.10

<u>Distribution of Fish Bone</u>						
(weight in g)						
<u>Unit</u>	<u>Teleost</u>	<u>Elasmo.</u>	<u>Total</u>	Wt. <u>per M<sup>3</sup></u>	Rank <u>Fish Bone</u>	Rank <u>All Bone</u>
1	635.6	107.5	743.1	530.8	4	5
2	121.0	25.6	146.6	148.1	7	7
3	896.8	95.0	991.8	953.7	1	3
3 E	140.5	26.8	167.3	743.6	2	2
4	380.0	36.5	416.5	680.6	3	1
5	83.4	25.5	108.9	360.6	5	4
6	<u>56.5</u>	<u>7.1</u>	<u>63.7</u>	249.8	6	6
Total	2,313.8	324.0	2,637.9			
Site average				546.2		

Even considering that the total for all bone in Unit 4 is affected by a single massive cetacean element, it appears that the relative distribution of fish bone is fairly consistent with the gross weight of all species. Feature 3 in Unit 4 has been interpreted as a processing area for fish, and Units 3 and 3 E are high in faunal remains deposited in Feature 4, a disposal pit. It would appear that fish were not prepared, cooked, or discarded in Unit 2, which is highest of all in burned stone content, or in the area of Units 5 and 6 which are the highest in lithic debitage (Tables 3.3, 3.4).

The preliminary examination of fish bone revealed a range of species native to inshore, deep water, and kelp bed habitats (Appendix 3). Taxa already identified - not represented as a comprehensive inventory - include the sharks, halibut, barracuda, bonito, and rockfish found at Muwu, plus others such as spotfin and yellowfin croaker, black surfperch, chilipepper,

corbina, etc., which are not reported from CA-VEN-11 (Resnick 1980). Two of the species are of particular interest. The giant seabass (Stereolepsis gigas) attains a length of five or more feet and may weigh 500 pounds; it was not recovered at CA-VEN-11, but did occur at Shisholop and at CA-SBA-1, at Rincon Point. It does enter shallow water at times, but landing a specimen of this size implies a high level of skill, organization, and technology. The Pacific ocean perch (Sebastes alutus) has never been reported from an archaeological context. It inhabits very deep waters around 500 feet deep. The vertebra identified shows no sign of digestive activity, so it did not enter the deposit as stomach contents of a predator (R. Huddleston, personal communication 1985).

The 33 otoliths represented 13 distinct species (Appendix 3); the most common were 19 members of the Family Scorpaenidae (four varieties), four examples of Pacific halibut, and three white croaker. By determining the seasonality of all but one of the otoliths, Huddleston concludes that fishing took place all year, but was most actively pursued during the late summer. This calendar cycle agrees with conclusions drawn by Landberg, whose ethnographic data also emphasize the importance of the submarine canyon off Point Mugu (1975:157-163).

By total bone weight alone, without reference to species or meat mass, a sample from Muwu (Resnick 1980:119) contained more than twice as much fish bone (1,717.8 g) as all mammal bone combined (750.5 g). For CA-VEN-110 as a whole, the ratio was nearly reversed, with 2,637.9 g of fish bone and 4,801.6 of mammal bone. Mammal bone predominated in Units 2 and 4 (cetacean); the proportion of fish bone was highest in Units 6 and 1, in that order. For both sites, faunal remains other than fish were primarily sea mammal rather than terrestrial game.

The analysis of CA-VEN-11 concluded that the actual edible flesh represented by the fish bone was more than twice as great as that derived from shellfish (Resnick 1980:111-112). To calculate these values, Resnick applied an arbitrary formula whereby fish bone weight was multiplied by 40, and shell weight was divided by three. For comparison only, and without comment on the method, the same ratios were applied to the weights from CA-VEN-110 (Table 3.11).

Table 3.11

Estimated Flesh Weight of Shell and Fish

<u>Unit</u>	<u>Shell</u>	<u>Fish</u>
1	36,205.1	29,724.0
2	10,283.7	5,864.0
3	48,826.1	39,672.0
3 E	7,887.6	6,692.0
4	14,299.3	16,660.0
5	7,188.2	4,356.0
6	<u>7,434.7</u>	<u>2,548.0</u>
Total, CA-VEN-110	132,124.8 g	105,516.0 g
Total, CA-VEN-11	2,453.2 g	5,387.0 g

Certain implications can be drawn from the calculation. The population at CA-VEN-110 was more dependent upon shellfish protein than their neighbors at Muwu. Only in Unit 4, already interpreted as an activity area related to fishing, did the calculated flesh weight for fish exceed that of shell. The preponderance of shell was greatest in Unit 2, where other constituents as well - notably the burned stone - differed from



the average distributions. The same calculations on a level by level basis within each unit revealed another difference from CA-VEN-11. For that site, Love concluded that there was a shift in subsistence whereby the overwhelming reliance upon fish protein in the lowest, earliest levels was being replaced by greater use of shellfish in more recent times (1979:51). This was not the case at CA-VEN-110 where analysis by levels showed parallel trends in quantity, either in gross weight or flesh weight, rather than reciprocal functions which could be interpreted as change.

### Density

The density of key midden constituents may be an indicator of specific activity areas within a single site, as discussed above, or may suggest either intensity of occupation or relative functions when different sites are compared. The validity of any such inferences is conditioned by sampling and analytical methods, and when population estimates are addressed, it is necessary to control for chronological span as well. For example, a high density of cultural materials may be the result of either a large population occupying a site for a short time, or a smaller group utilizing a single location over a long period. The most meaningful comparisons are based on volumetric analysis, i.e., weight of constituents per cubic meter; as long as the sample is adequate, this overcomes discrepancies in the amount excavated, increments of excavation, or sampling method. It requires that the variables have been quantified by any stated unit of volume. The statistics from Muwu cannot be used in arithmetic comparisons because the quantities were derived from a 1000 g sample by weight.

Table 3.12  
Comparative Density of Shell and Bone at Six Sites  
 (by grams per cubic meter)

	*CA-	**CA-	**CA-	**CA-	**Little	***CA-
<u>Shell</u>	<u>VEN-110</u>	<u>VEN-3</u>	<u>SLO-2</u>	<u>SMI-1</u>	<u>Harbor</u>	<u>VEN-11</u>
Unit 2	31,163					
Unit 3	140,574					
Total	82,065	42,813	176,725	0,083	201,242	Approx. 10% more than VEN-3

Bone

Unit 2	673					
Unit 4	5,945					
Total	1,818	609	1,172	420	5,230	Twice as much as VEN-3

\* Analysis, this report. Highest and lowest units included to indicate range.

\*\* Compiled in Greenwood 1972:7

\*\*\* Comment in Resnick 1980:68

Table 3.12 suggests certain differences among the sites compared. Accepting the statements about CA-VEN-11 as written, it appears that CA-VEN-110 contained a shell density about twice as great as CA-VEN-3 (Shisholop) or Muwu, both of which occupied a comparable environmental setting on a sandy outer coast. The shell density was very much less than the two island sites or CA-SLO-2, on a coastal terrace at Diablo Canyon which was occupied for many thousands of years. If Resnick's estimate is accurate, CA-VEN-110 contained a third greater bone density than Muwu, and three times the density of CA-VEN-3. For the site as

a whole, it was second only to Little Harbor, although the bone content within Unit 4 exceeded the density of Little Harbor as a whole. By radiocarbon or the relative dating of diagnostic artifacts, CA-VEN-110, CA-VEN-11, and CA-VEN-3 do appear to have been occupied contemporaneously, on the basis of currently available data. There are historical and ethnographic accounts that provide a population estimate for Shisholop and ascribe major village status to that site and Muwu; although the population remains an unknown variable for two of the three sites, the measure of density suggests that food related activity was the most intense at CA-VEN-110.

#### Flora

A matted fragment of vegetal material recovered from the 80-90 cm level of Unit 1 was tentatively identified as Zostera marina resembling the woven bedding or matting previously seen at Muwu (C. Rozaire, personal communication 1985; Van Bergen n.d.:103). Plant remains over Feature 4 were probably cattails (C. Rozaire, personal communication 1985). Two burned seeds have not been identified.

#### Radiocarbon Dates

Five samples were submitted to Beta Analytic Inc. for radiocarbon analysis (Table 3.13).

Table 3.13

Radiocarbon Dates from CA-VEN-110

Lab. No.	Material	Provenience	Date
Beta-13627	Shell	Unit 2, 10-20 cm	1020 $\pm$ 60 B.P.
Beta-13628	Charcoal	Unit 2, 50-60 cm	1020 $\pm$ 70 B.P.
Beta-13629	Shell	Unit 2, 90-100 cm	1230 $\pm$ 60 B.P.
Beta-13630	Shell	Unit 4, Level 4	960 $\pm$ 60 B.P.
Beta-13631	Shell	Unit 4, Level 10	1200 $\pm$ 70 B.P.

The suite of dates is internally consistent from upper to lower levels, and the analysis of the charcoal sample is in agreement with that of the shells. Marine shell dates can be given two corrections, for isotope effect and reservoir effect, but they would cancel each other out in this case. In replying to questions about possible contamination from either treated sewage in Calleguas Creek or the venting of aviation fuel, Beta Analytic advised that the probability was unlikely. The former, considered the more possible, would make the samples appear younger than they really are (i.e., the site would be older). Any effect of the fuel would produce older ages, but since the material is organic, it would contribute nothing to the inorganic chemical extraction of shell carbon. The monitor charcoal tends to negate any suspicion of contamination as it appears closely stratigraphic with the bracketing shell (J. Stipp, personal communication 1985).

For purposes of comparison, radiocarbon dates from Simo'mo and Muwu are provided in Table 3.14.

Table 3.14

Radiocarbon Dates from Simo'mo and Muwu

Lab. No.	Material	Provenience	Date
<u>Simo'mo</u> (CA-VEN-26)			
UCR-712	Shell	K-5, 30-61 cm	1065 + 150
UCR-710	Shell	K-8, 61 cm	1000 + 150
UCR-709	Shell	K-8, 122 cm	1335 + 150
UCR-711A	Shell	K-8, 183 cm	1730 + 120
UCR-711B	Charcoal	K-8, 183 cm	1320 + 100
UCR-0212	Shell	-	3160 + 150
<u>Muwu</u> (CA-VEN-11)			
UCLA 2184A	Charcoal	S3E0, 105 cm	290 + 60
UCLA 441A	Conchiolin	House D, 0-40 cm	400 + 140
UCLA 440A	Conchiolin	Datum A, 0-40 cm	500 + 130
UCR-0440C	Shell	-	570 + 120
UCR-0440B	Shell	-	600 + 140
UCR-0441C	Shell	-	670 + 130
UCR-0440A	Shell	-	880 + 150
UCR-0441A	Shell	-	880 + 150
UCR-0441B	Shell	-	900 + 150
UCR-0896	Shell	-	2330 + 90

UCLA dates (Love 1980:124); UCR dates (Breschini, Haversat, and Erlandson 1983:n.p.)

Each site in Table 3.14 has a single ambiguously early date which has not been discussed or explained. Omitting these two anomalies, the dates uncorrected except for the error factor suggest the following ranges:

CA-VEN-110	A.D. 660-1050
CA-VEN-26	A.D. 735-1035
CA-VEN-11	A.D. 900-1720

To refine the comparison of dates from CA-VEN-110 with those from Simo'mo, for which C-13 data are available, further correction is needed. On the assumption that the -110 shells dated were similar in type and original reservoir to the UCR sample, Beta Analytic suggests that a C-13 adjustment (normalization) of 410 years to the older direction is appropriate. If the same reservoir correction of 560 years for southern California used by UCR is applied, the change to the CA-VEN-110 dates would be to subtract 150 years from each shell date (J. Stipp, personal communication 1985). The net effect of applying these corrections is to establish the contemporaneity of the two sites even more firmly than the raw data of Table 3.13 would suggest. All of the CA-VEN-110 dates then fall within the period of approximately A.D. 570-840; Martz postulated that the main focus of occupation at Simo'mo took place around A.D. 700 (1984:156). The dates for Muwu were adjusted by tree ring calibration, and conchiolin ages were corrected for upwelling (-200 years) and fractionalization (-100 years); calendar age was reported as sixteenth and seventeenth century (Love 1980:124). This is not only the latest of the three sites by these determinations, but there is no overlap between Muwu and the two earlier occupations.

#### Tests of Soil Chemistry

A series of tests was run to determine if various chemical tests would provide another set of meaningful data. Samples from both the midden and adjacent areas were investigated to determine:

which, if any, chemical test(s) would be sensitive to the presence of a cultural deposit, and

what test(s), if any, would be sensitive to changes within the midden.

Soil samples were taken from each excavation unit, selected trenches, from areas off the site, and the waterways. They

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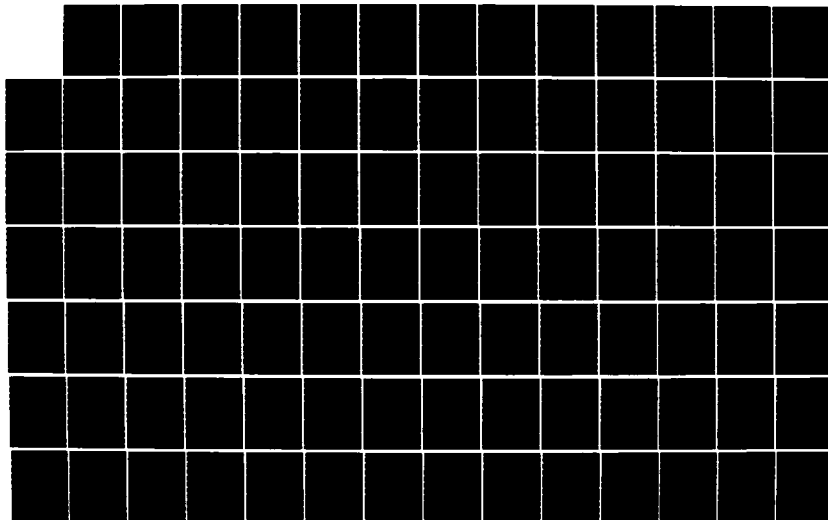
ARCHAEOLOGICAL STUDY OF CA-VEN-110 VENTURA CALIFORNIA  
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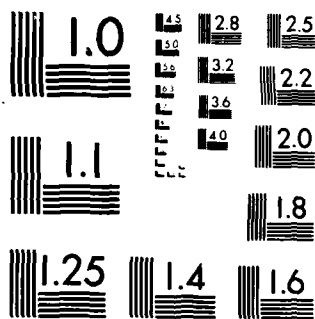
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MICROCOPY RESOLUTION TEST CHART  
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consisted of approximately 20 g, taken from each described stratum within a unit or trench. A Hach Soil Test Laboratory was utilized to measure pH, phosphorus, and potassium available in the soil. Results were determined colorimetrically with a filter photometer, and diluted extracts were treated with indicator reagents which produced colored solutions with intensities proportional to the nutrient level.

Initially a series of pH tests was run on samples from the upper and lower limits of units and trenches to determine the extent of variability (Table 3.15). There appears to be a very general trend for the measurements to become increasingly alkaline with depth, although interpretations are constrained by the range and inconsistency of measurements.

Table 3.15

Measurements of Soil pH

Unit	Level or Stratum											
	1	2	3	4	5	6	7	8	9	10	11	12+
1	7.8	7.8	7.3	8.1	-	-	-	-	7.8	7.1	-	-
2	7.5	7.5	7.6	-	-	-	-	-	-	-	8.5	-
3	8.4	8.6	9.0	8.5	8.3	-	-	-	-	-	-	-
5	8.1	8.4	8.1	8.5	-	-	-	-	-	-	-	-
6	7.5	8.6	8.5	8.6	8.2	8.7	-	-	-	-	-	-
Trench												
8	8.2	8.6	8.7	8.8	8.1	8.4	9.0	8.4	-	-	-	-
11	7.0	7.5	8.4	8.1	8.1	7.9	-	-	-	-	-	-
One mile north of site												
	8.3											

- = Sample not tested

A limited series of phosphorus tests was then run. The results of the analysis were high within a narrow range of variation

(Table 3.16). The effort was abandoned as not likely to provide cultural interpretations.

Table 3.16

Measurements of Soil Phosphorus  
(pounds per acre)

Unit	Level or Stratum											
	1	2	3	4	5	6	7	8	9	10	11	12+
3	~	>500	>500	~	~	~	-	-	-	-	-	-
Trench												
11	>500	>500	>500	>500	>500	>500	-	-	-	-	-	-
17	~	-	-	-	-	-	-	-	~	-	-	>500
18	360	-	-	-	-	-	-	-	425	-	-	>500
19	>500	-	-	-	-	-	-	-	>500	-	-	~
One mile north of site												
	>500											

- = Sample not tested; ~ = off scale

Tests were then run for potassium on samples from selected levels of Unit 3 because it has been suggested that this element is a sensitive indicator of fish remains (Hach 1977:16). To evaluate the consistency of the readings, multiple measurements were made for each stratum (Table 3.17). As with the pH series, there is a general trend for the readings to get stronger with depth and then decrease into sterile. The reliability of this trend, as with the pH, is suspect because there is so much variation within the same level, e.g., Stratum 2 (800-1200), that potential interpretations need further study.

Table 3.17

Potassium Series in Unit 3

Stratum	Pounds per Acre
1	700
2	800, 850, 900, 900, 900, 1200
3	700, 800, 1000
4	950, 1000, 1100
5	1000, 1000
Sterile	375
One mile north of site	345

In summary, the limited chemical testing conducted at CA-VEN-110 was exploratory in nature to determine which soil tests, if any, might be of utility in further investigations. The tests proved inconclusive thus far. There is some indication that the potassium series might be of value, but further testing and professional consultation will be necessary to determine if the range of variation within the strata is too great for meaningful interpretations.

Soil Observations

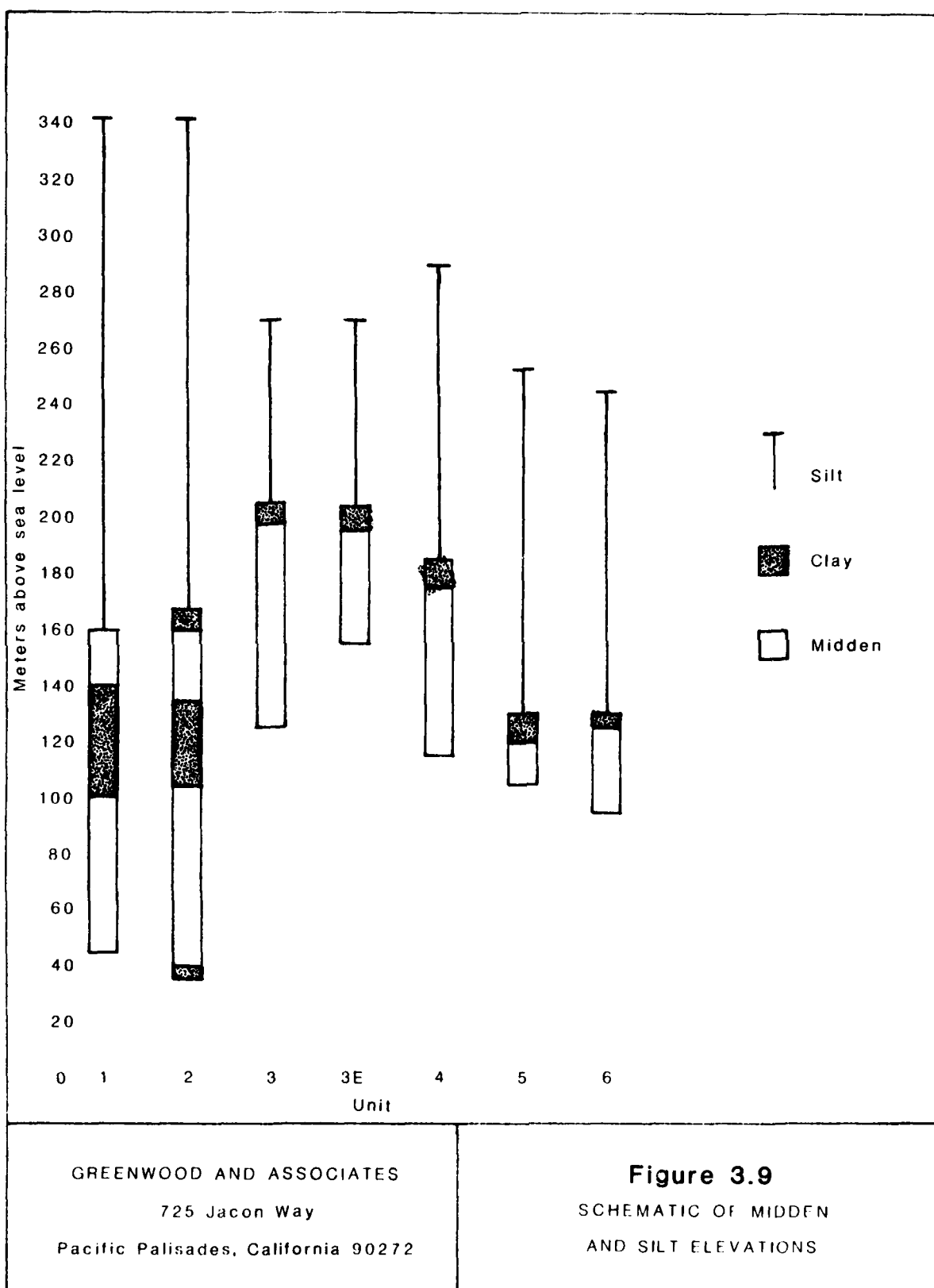
Information was gathered from the various field methods used during the investigation in order to initiate a data base from which interpretations regarding stratigraphy and deposition can be drawn. The observations were recorded from wall profiles of the seven excavation units and 19 trenches. The discussion of soil characteristics which follows is based upon the observations and is presented for reference in future work. The proposed classifications and interpretations must be regarded as tentative.

There are two basic formation processes that characterize the soils of CA-VEN-110: estuarine and fluvial. The former contains the archaeological component while the latter represents conditions present since channelization of Calleguas Creek in historic times.

The first process is the result of Calleguas Creek meeting the tidal prism, which in turn developed into a broad tidal marsh. These soils have been designated as tidal flats by the United States Department of Agriculture, Soil Conservation Service and described as "highly stratified with thin layers of very fine sandy loam, silt loam, clay loam and clay... They are nearly level coastal areas that are periodically covered by tidal waters" (USDA, SCS 1983:7). During the late prehistoric and early protohistoric periods, "Revolon Slough and Calleguas Creek were intermittent and only contained large amounts of water during winter storms" (Ibid:3). The second process (fluvial) developed after "channelization of Calleguas Creek and Revolon in 1884 and 1924" (Ibid:3) during which the sedimentation rate increased ten-fold.

#### Site Stratigraphy

The stratigraphy of CA-VEN-110 is consistent with the Soil Conservation Service observations. The estuarine component (0.3 m to 2.1 m above sea level) consists of lenses of clay and midden of varying thickness. The fluvial deposition (2.1 m to 3.4 m) contains lenses of "silt loams and sandy loams" (Appendix 1), also of varying thickness. These distinctions are illustrated in Figure 3.9 which shows the elevation of each process above sea level as they relate to the excavation units. Since the unconformity between these two processes is sharply defined, it is evident that fluvial formation is post 1884 when the creek was channelized. Prior to that time the site area was subjected to the intermittent flow of Calleguas Creek and periodic inundation by tidal action. These factors would account for the alternating lenses of midden and clay that were encountered. Table 3.18



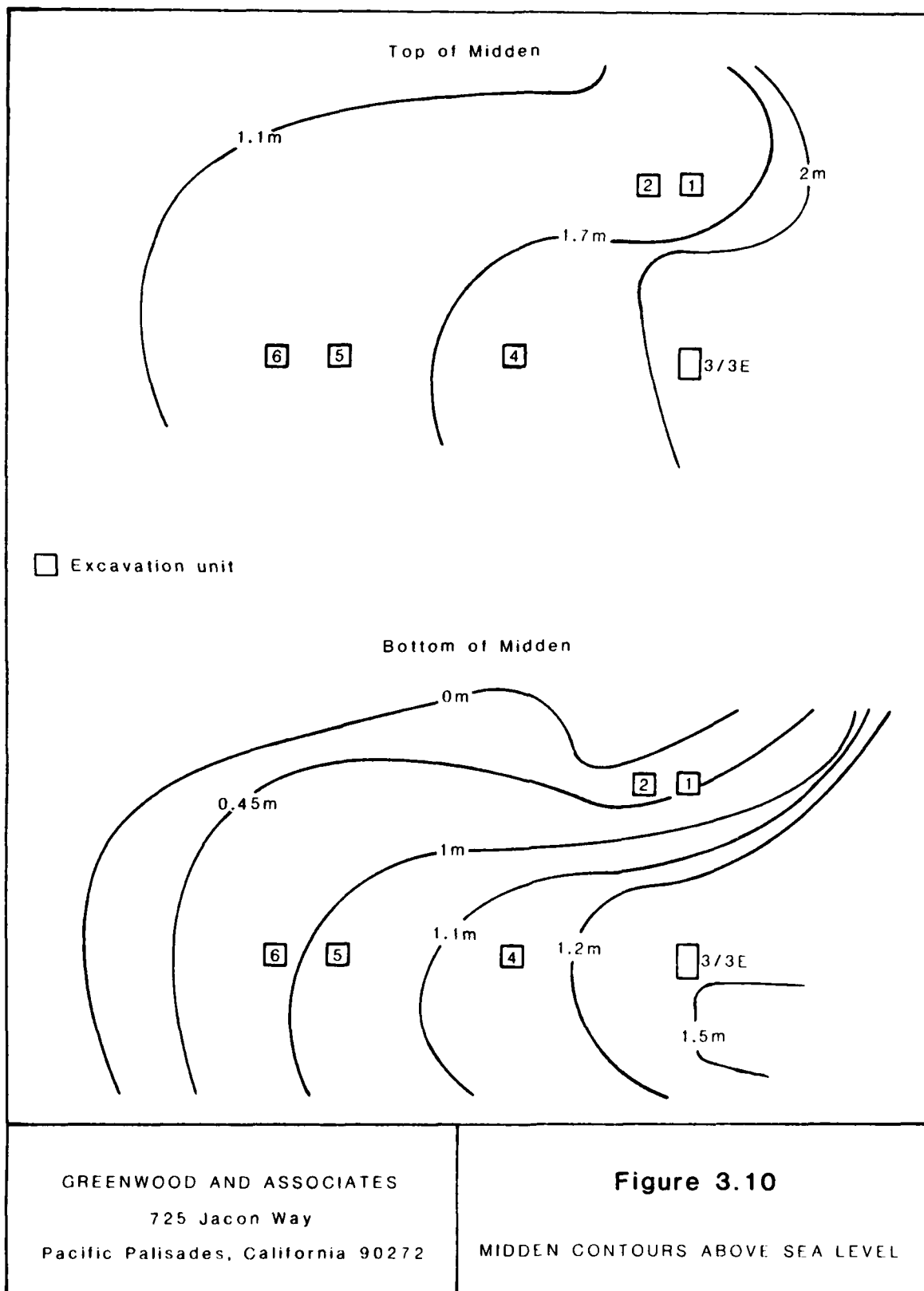
summarizes the number of separate midden lenses encountered in each unit and their approximate thickness.

Table 3.18  
Thickness of Midden Deposits

Unit	No. of Lens	Thickness of Lens (cm), Upper to Lower
1	3	A - 55; B - 6; C - 30
2	2	A-14; B-41
3*	2	A-56; B-62
3E*	2	A-29; B-17
4	5	A - 6; B - 2; C - 2; D - 16; E - 2; F - 2
5	1	A - 15
6	1	A - 28

\* For these two units the lenses are artificial in that they represent an intrusive cultural deposit (Feature 4).

As evident in Table 3.18, Units 1 and 4 contain the largest number of lenses. To investigate the reasons for the differing number of midden lenses, the elevations indicated in Figure 3.9 were contour mapped (Figure 3.10). High ground is or was to the east and north. In fact it would appear on the basis of these contours that there was a steep slope to the west of Unit 3 while to the south there was a rather more gentle downward slope. The data imply that the southern and western areas of the site would be more frequently inundated by either tides or creek flow. Also it would be expected that the alternating lenses of clay would be thicker in the lower elevations of the site since presumably they would be submerged for a longer period of time and with greater deposition of clays. These expectations are borne out in the profiles for Units 1, 2, and 4. Units 1 and 2, both lower in elevation, have a substantial clay lens, upwards of 30 cm, while Unit 4, higher in elevation, has numerous strata of thinly bedded clay. It would appear that Unit 4 was at an elevation that was



frequently inundated. Since the clay beds are thin, it would seem that these inundation periods were of a relatively short duration. It is possible that several of the clay beds in Unit 4 were deposited during the same time as the single 30 cm clay lens in Units 1 and 2 was being formed.

## Erosion

### Vertical Erosion

The transition between the two formation processes is ambiguous in that there is no marker or historical record that indisputably indicates the maximal vertical extent of intact midden. It cannot be proven that the highest elevation of midden in 1985 was indeed the final deposited lens of midden. In some areas there is good evidence that the fluvial process has eroded the midden (Units 4, 5, and 6). In the wall profiles for these units a clay lens has been eroded off as well as an unknown amount of midden. In Units 1, 2, and 3, there is a lens of clay immediately overlaying the midden. In Units 4, 5, and 6 there is a lens of sand over the midden and in the case of Unit 4 there is shell mixed in with the sand. Since Unit 3 has the highest midden elevation (2.1 m msl) and is capped with clay, all units below it should also be capped with clay, assuming that the water had equal access to all of the site. If this assumption is correct, then Units 4, 5, and 6 have all been eroded.

The extent of the vertical erosion is difficult to address because there is no record of the original surface contours prior to the various modifications. For instance, the midden in Units 5 and 6 may be thin either because of loss at the top, or because they were near the periphery of the site. According to Figure 3.10, the base of Units 1 and 2 is only slightly lower than Units 5 and 6 although the midden is twice as thick. Therefore, it is probable that there has been some vertical erosion in Units 4, 5, and 6, but the extent of loss is unknown.



### Horizontal Erosion

The evidence for horizontal erosion is better documented. The 1980 investigation (Singer and Romani 1980b) established the maximum possible extent of the site as 660 m north-south by 122 m east-west with an area of 80,520 m<sup>2</sup>. The current investigation indicated that the size of the site is 200 m north-south by 60 m east-west with an area of 12,000 m<sup>2</sup>. This would indicate a decrease of 85%. These figures are to some extent misleading. First, the northern extent of the site in the 1980 investigation was based on a single auger hole which was 361 m north of the next positive findings. If this reading is disregarded, the north-south extent becomes 305 m. The east-west distance remains the same with the area now equalling 37,186 m<sup>2</sup>. In a comparison of the maps of the two investigations there is a decrease of 58 m north-south. Most of the decrease in site area comes from the eastern side of the site and the south quarter. In a further refinement of the site area, the test showed that the deposit of midden in the far southeast edge of the site was only a few centimeters thick. This additional area, extrapolated north, equals 10,845 m<sup>2</sup> of site area. If this section is subtracted from the total, the net site area would be 14,784 m<sup>2</sup>. Compared with the current conditions this would be a decrease of 19%.

The sparse midden deposit located next to the east levee has been lost. The explanation for its loss is unknown at this time. There are two possible explanations: 1) The site was eroded away by flood, or 2) this area was removed during silt removal operations conducted by the County of Ventura.

In conclusion, it is evident that there may have been a loss of site area (minimum of 19%) which appears to have centered on the south side. It is further noted that the volume of loss is not known since the thickness of the deposits found in 1980 was not sought. Table 3.19 provides a summary of the site size estimates of the various investigations conducted at CA-VEN-110.

Table 3.19

Site Size

(m)

Investigation	North-south	East-west	Area (m <sup>2</sup> )
Briuer and McIntyre			
1975	152	122	18,544
Kirkish 1978	243	105	25,515
Singer and			
Romani 1980a	660	122	80,520
Current investigation	200	60	12,000

Another factor of continued concern are the reports (Singer and Romani 1980a, 1980b; and C. Singer, personal communication 1985) of midden farther north of the investigated site area. Singer (personal communication 1985) reports midden from CA-VEN-110 as far north as Simo'mo. The origin of such discontinuous areas of midden between the two sites of CA-VEN-110 and Simo'mo remains undetermined but suggests that the two sites are linked at least on a sporadic physical basis.

#### 4. ARTIFACTS

##### Ground Stone

The only stone vessel recovered was a surface find collected near the east levee (597). It is a fragment of a small, shallow sandstone bowl, smoothly ground inside and out, with a rounded rim. If whole, it was probably less than 12.0 cm in diameter; maximum thickness present near the base is 2.1 cm.

Three burned, broken cobbles (600, 601, 602) may have been manos. None is shouldered, edge ground, pitted, or pecked, but each has at least one smooth surface which may have been used. There is no certainty in the identification, but they have been preserved for comparison with materials from this or other sites. They were not washed in the field, but processed in the laboratory for the possible recovery of pollen.

One burned steatite fragment (596) probably represents a broken comal which would have been 2.5 cm thick. Both flat sides are present, but all edges are broken. Four other small pieces of steatite were recovered, but lack any finished edges or identifiable shape and are not counted as artifacts.

##### Flaked Stone

The nine whole or broken projectile points include one complete small triangular form with concave base (585), and five which are either definitely or probably lanceolate (584, 586, 587, 590, and 609). One of the latter group (586) has serrated edges. Three convex fragments larger and thicker than the others (588, 589, 606) may be fractions of either lanceolate bases or blade edges. Sizes and materials are tabulated below; a figure in parenthesis represents an incomplete measurement. Dimensions are recorded in centimeters and grams.

Table 4.1  
Description of Projectile Points

<u>Cat.</u>	<u>Material</u>	<u>Length</u>	<u>Width</u>	<u>Thick.</u>	<u>Weight</u>
584	Fused shale	(2.5)	1.1	0.55	1.3
585	Fused shale	2.2	1.1	0.35	0.7
586	Fused shale	(4.1)	1.2	0.65	2.9
587	Fused shale	(1.5)	1.1	0.40	(0.6)
588	Chert, black	(2.8)	-	0.70	(1.4)
589	Chert, brown	(3.0)	-	0.70	(2.6)
590	Chert, black	(2.0)	(1.3)	0.60	(1.4)
606	Chert, black	(0.7)	(1.5)	0.70	(0.8)
609	Chert, black	(0.7)	1.2	0.40	(0.3)

One bifacial flake knife (592) is D-shaped with one flat, unedged surface, as if for a finger rest. The remaining 75% of the periphery is usable, and all surfaces are flaked. The basalt artifact is 7.6 cm long, 6.6 cm wide, 2.2 cm thick, and weighs 133.5 g.

The single hammerstone recovered (591) is an exhausted nodular core of mottled tan to black cryptocrystalline, battered around the entire margin. The dimensions are 7.1 x 6.3 x 4.0; the artifact weighs 282.8 g.

Drills are represented by one stubby, bipointed chert example (594) and five very small chalcedony specimens. The larger drill is 3.0 x 1.8 x 1.4 cm, weighs 9.5 g, and shows most evidence of wear at one end, although both are suitably formed. The tool is an appropriate size and shape for woodworking or reaming out the center of a fishhook. The microdrills are of a size which could have been used to perforate beads. Two (593, 595) are tiny bladelets, or lamellar flakes, not further modified but showing rotary crushing at one end. They are 1.5 and 1.4 cm long, 0.4 and 0.3 cm wide, 0.35 and 0.25 cm thick, respectively, and weigh 0.2 and 0.1 g. Another bladelet (668) has been used along one long

edge as well; it is 2.5 cm long, 0.7 cm wide, triangular in cross section, and weighs 1.0 g. The remaining two are small interior flakes which have been further reduced in width to form a drilling tip which is triangular in cross section. Artifact 624 is 1.8 cm long, 0.8 cm wide, 0.35 cm thick, and weighs 0.6 g; drill 650 is 1.4 cm long, 0.6 cm wide, 0.4 cm thick, and weighs 0.4 g. King (personal communication 1985) has commented that 593 and 595 are Santa Cruz Island bead drills, while 624 and 650 represent an earlier type used for the same function.

More amorphous is a group of 19 small artifacts which gradate from a prepared side and end scraper, to cores which have been used on a fracture edge, to utilized flakes. The best defined (608) is a subrectangular interior flake of black chert, 2.8 x 2.3 x 1.0 cm, with a concave working edge on one side and a straight edge on one end; the other end has been thinned but does not evince wear. At least six flakes show more than casual use of suitable edges. From 2.2 to 3.4 cm long, four are chert (617, 628, 632, 640), and the others are fused shale (614, 639). Four small cores are all less than 2.9 cm in length. Three are chert (615, 622, 651), and the fourth is fused shale (648). Two have been modified for use of the sharp edges: 648 on the two opposed sides, and 651 on one long side and the adjacent end. At this stage of preliminary analysis, the group is characterized as notably small, unifacially retouched, with used edges often concave. Many of the artifacts represent the final recycling of fragmented or exhausted core remnants.

### Flakes

While sorting the screened residue, 171 small stone flakes were recovered. Distribution and raw materials are shown in Table 4.2. Almost all are very small (average weight = 0.7 g), interior, or tertiary detritus. According to the preliminary identification of lithic raw material, 75.4% of those recovered are

cryptocrystalline. In the discussion which follows, chert and chalcedony have been combined under this rubric since distinction between the two raw materials on the basis of such optical properties as translucency alone may be misleading on such small items; both chert and chalcedony are present. Fused shale accounts for 17.6% of the flakes.

Table 4.2

Description of Flakes

<u>Stage of Manufacture</u>	Number			Percent		
	Ter	Sec	Pri	Ter	Sec	Pri
Cryptocrystalline	122	6	1	71.3	3.5	0.6
Fused shale	28	2	-	16.4	1.2	-
Basalt	2	3	1	1.2	1.8	0.6
Quartz	3	-	-	1.8	-	-
Quartzite	<u>3</u>	<u>-</u>	<u>-</u>	1.8	-	-
	158	11	2			

Screen Size in Inches

	<1/4	<1/2	<1	>1	<1/4	<1/2	<1	>1
Cryptocrystalline	27	63	27	12	15.8	36.8	15.8	7.0
Fused shale	9	16	4	1	5.3	9.4	2.3	0.6
Basalt	-	-	2	4	-	-	1.2	2.3
Quartz	-	1	2	-	-	0.6	1.2	-
Quartzite	<u>-</u>	<u>-</u>	<u>2</u>	<u>1</u>	-	-	1.2	0.6
	36	80	37	18				

Ter = tertiary; Sec = secondary; Pri = primary

Within the cryptocrystalline group of 129 flakes (75.4% of total), were clear, pinkish, or bluish materials which occur commonly as veins and nodules in the Conejo volcanics within 5-10

km northeast of CA-VEN-110. Examples that contain zones or patches of various colors can occur at contact zones with silica-rich sedimentary formations, and are sometimes called "meta-cherts." Nodules and veins are also found in many conglomerate regions of the Santa Monica Mountains, and in streams. The banded cherts, most frequently brown and black at this site, are found in numerous small and isolated areas of the Santa Monica Mountains in exposures of the Calabasas and Monterey formations. Cherts occur as thin strata or veins in silty and shaley sedimentary deposits or as rolled stream pebbles. Known locations are within approximately 30 km of the site (Singer 1984:206), although other sources may be closer.

One unusual green flake (647) may be a Temblor Range chert which derives its name not from a source location or particular formation, but only from its occurrence in sites around this range near the Chumash-Yokuts border, approximately 150 km from CA-VEN-110 (Pierce, Clinger, and Gamble 1982:7-2). At least two other chert flakes, orange in color, may originate in the Franciscan formation of the Santa Ynez or San Rafael Mountains in Santa Barbara County, some 50-100 km from this site (Singer 1984:207).

The fused shale is of particular interest. Archaeologists have long assumed that this material originated in Grimes Canyon, and half a century ago, VanValkenburgh described the popularity and distribution of its use, and advanced the native name of Kaulul for its source (1935: No. 173). It occurs naturally in the exposed burned Miocene shale beds in at least three locations in the Oak Ridge formation: at Grimes Canyon, Happy Camp Canyon, and South Mountain, and also at Tapo Canyon in the northeast part of Simi Valley, near the north end of Las Virgenes Creek in Calabasas, and perhaps in the Thousand Oaks area (Foster and Greenwood 1985:16). Hematite, as found at CA-VEN-110, co-occurs with fused shale at Grimes Canyon.

The basalt, characteristically solid gray or black, medium to coarse grained, may have originated in the flows, dikes, sills, or irregular bodies of the Santa Monica Mountains, particularly in the western area of the Conejo volcanics within 10 km northeast of the site. Metamorphic quartzites could be obtained as stream cobbles or pebbles, beach gravels, or in conglomerate formations of the Santa Monica Mountains. The clear to white quartz and quartz crystals are also local varieties occurring in the basaltic materials of the Conejo volcanics, the chalcedony and metachert contact zone deposits in the Santa Monica Mountains, or as stream rolled cobbles and pebbles (Pierce, Clinger, and Gamble 1982:7-4; Singer 1984:203-205).

The fine grained lithic materials (chert, chalcedony, fused shale) are most commonly used to manufacture finer and smaller tools such as projectile points, graters, drills, and other light multi-purpose implements, whereas the coarser basalt, quartzite, and quartz are usually found as heavier tools such as hammerstones or choppers. Table 4.2 confirms that the flakes at CA-VEN-110, as well as the finished tool inventory, represent a fine grained stone industry in numerical ratio of 159:12, or 92.9% to 7.0%. Further, of the 34 flaked tools, cores, and utilized flakes and cores, 33 were of fine grained material and less than 3.0 cm in length, and only one artifact (592) was basalt.

Various approaches to the analysis of chipping detritus have been proposed by Gamble et al. (1982:[8] 39-40). They point out that clustered flakes may indicate an activity area, but that waste flakes may also enter into trash deposits from cleaning a work area. They also suggest that fine grained flakes smaller than 1/4 inch were produced by pressure flaking, e.g., the final stages in the production of projectile points or other small bifaces. Other tool types, earlier stages in the manufacturing process, and the shaping of coarse grained materials are more apt to result in larger flakes. In this collection, all stages of



the manufacturing are represented, but primary core reduction has left only two large primary flakes greater than one inch (1.2% of total), one basalt and the other chert. All of the cores, core fragments, and utilized cores are small (less than 3.0 cm), and all are fine grained materials. In spatial distribution, the greatest density occurs in Units 5 (highest) and 6, with the only other significant quantity recovered from the trash disposal feature contained in Units 3 and 3 E.

The 18 waste flakes between one and two inches in length (13 fine grained; 5 coarse grained) suggest the use of prepared cores. The 36 flakes smaller than 1/4 inch are all tertiary, fine grained, and seem to indicate late stages of lithic reduction by pressure flaking. The largest group comprises the 80 flakes between 1/4 and 1/2 inch, of which 79 are fine grained and only one is coarse; these suggest middle and late production stages with use of either pressure or soft hammer techniques.

The flake total appears relatively low, although the nature of the collection suggests that more and smaller flakes would be recovered with use of 1/16 inch mesh for screening. No changes in the use of raw material types over time can be demonstrated.

#### Other Stone

##### Quartz Crystal

One fragment of a quartz crystal (647) was recovered in Unit 6, Level 3.

##### Other Stone

Three small pebbles are either wholly (599) or partly (598, 643) covered with asphaltum. The former is 3.7 x 3.2 x 2.5 cm; the latter, both with one broken surface, are 4.1 x 3.5 x 1.6 cm and 2.6 x 1.7 x 1.1 cm, respectively. Two are from Unit 5; the other (598) from Unit 4.

Two otherwise unmodified cobbles, both from Unit 1, have spots or stains of asphaltum. One broken cobble (603) has asphaltum on one tapered end. The other (604) is whole, burned, and stained at one end and on both flat faces; it has not been classified as a mano, but both faces are smooth.

### Fishhooks

Although some are only fragmentary, the five fishhooks represent a minimum of two types: bone with knob, and Mytilus of circular form with grooved shank. The bone specimen (568) would probably be the largest if whole; the fragment is 3.1 cm long and 0.9 cm wide across the shank. It falls within Heizer's Type 1 (1949), knobbed shank with simple point. The inner line of the shank is straight, suggesting that the form may have been J-shaped rather than circular. The most nearly complete of the shell hooks (566) is circular with a grooved shank and simple point, comparable to Heizer's Type 2 (1949). It is 2.9 cm in maximum diameter, 0.7 cm wide across the shank. If by "cortex," Strudwick means periostracum, this would be a left handed fishhook by his definition (1985:40). He found this orientation in 57% of the Mytilus fishhooks from Muwu (1985:44). The three small fragments (564, 567, 569) are all shanks or tips, lacking evidence of the means of attachment. All are Mytilus, and by Strudwick's classification, 564 would be left handed. Another possible example of fishing gear is described below with the bone artifacts.

### Bone Artifacts

One bone artifact (578) from the 90-100 cm level of Unit 1 is an awl made of split deer bone, 11.2 cm long. The head of the bone is almost entirely ground away, the shaft is triangular in cross section, and the distal end tapered to a point which begins 3.3 cm from the tip. Another complete artifact (579) was part of Feature 3 in Unit 4 (Figure 3.6). Slightly bowed in longitudinal

profile, it is 8.1 cm long. One end is tapered; the other is thinned, rounded, and covered with asphaltum for 3.9 cm. It is probably one element of composite fishing equipment.

More enigmatic is a split fragment of worked bird long bone presently 11.8 cm long (580). One end is cut and polished, but the other is merely broken. Below the finished end by 2.5 cm, on the broken edge, is a damaged area which might be either the perforation of a whistle or simply the result of gnawing. Traces of asphaltum around the interior of this hole suggest that an asphaltum stop had been present. Four small bone fragments all less than 1.9 cm long (581, 582, 583, 652) are burned, highly polished, and may represent broken awls or other artifacts. Two hollow bird bone fragments may have been beads or small whistles; 207 is 1.5 cm long with both ends broken, and 575 is 2.5 cm long with one end clearly cut.

#### Beads and Ornaments

A total of 557 beads of shell, stone, and glass was evaluated by King (Appendix 4). His examination was limited to a discussion of the types present and an estimate of the time spans represented. Table 4.3 is a quantitative summary of the bead types.

In Appendix 4, King has suggested that beads under 3.5 mm may be underrepresented in the sample because of screen size. However, 79 beads, or 14%, were between 2.7 and 3.4 mm. Any bias in the range of sizes would affect chronological interpretations, primarily at the recent end of the span, but according to a preliminary assignment of the temporally sensitive beads to unit and level, it appears that, relative to each other, they are stratigraphically consistent with their assigned chronology.

Table 4.3  
Distribution of Bead Types

Unit/ Level	O. Well	O. Cupped	O. Myt.	O. Rough	O. Disk	Hel. ruf. Epl.	O. Saucer	Misc. Shell	Glass	Stone	Total
1/7	3	0	0	0	0	0	0	0	0	0	3
8	3	3	2	0	2	0	0	0	0	0	10
9	38	10	5	0	2	0	2	1	0	0	56
10	12	3	0	0	0	0	1	0	0	0	16
11	2	1	1	0	0	0	1	0	0	0	5
12	<u>1</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>
Sub-											
Total	57	17	8	0	4	0	4	1	0	0	82
2/1	2	0	0	2	0	0	1	0	0	0	5
6	0	0	2	0	0	0	0	0	0	0	2
7	2	1	0	0	2	0	0	0	0	0	5
8	5	8	1	0	0	0	0	1	0	0	15
10	<u>12</u>	<u>8</u>	<u>4</u>	<u>0</u>	<u>8</u>	<u>1</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>32</u>
Sub-											
Total	21	17	7	2	8	1	1	2	0	0	59
3/1	4	0	0	0	0	0	0	0	0	0	4
2	2	0	0	0	0	0	0	1	0	0	3
3	30	6	3	3	2	0	1	1	0	1	47
4	32	5	1	10	3	1	0	4	0	0	56
5	21	5	1	8	1	2	0	2	2	0	40
6	28	2	2	13	0	1	0	0	1	0	47
7	9	2	2	4	3	1	0	2	1	0	24
8	3	1	1	0	2	1	0	2	1	0	11
9	3	1	3	3	1	0	0	1	0	0	12
10	1	0	1	4	0	0	0	0	0	0	6
11	<u>1</u>	<u>2</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>4</u>
Sub-											
Total	134	24	14	43	12	6	1	14	5	1	254

Table 4.3 (continued)

3E/1	11	4	1	5	3	0	0	1	0	0	25
2	3	0	0	1	3	0	0	1	0	0	8
3	<u>4</u>	<u>0</u>	<u>2</u>	<u>2</u>	<u>11</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>0</u>	<u>0</u>	<u>21</u>
Sub-											
Total	18	4	3	8	17	0	0	4	0	0	54
4/1	2	0	1	0	0	0	0	1	0	0	4
8	4	3	3	0	4	0	0	0	0	0	14
9	8	0	2	0	0	0	0	0	0	0	10
10	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>
Sub-											
Total	15	3	6	0	4	0	0	1	0	0	29
5/2	1	0	0	0	0	1	0	2	0	0	4
3	15	7	4	1	0	0	0	4	2	0	33
4	<u>3</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>3</u>
Sub-											
Total	19	7	4	1	0	1	0	6	2	0	40
6/2	0	2	1	0	0	0	0	0	0	0	3
3	3	4	1	0	0	0	0	0	1	0	9
4	3	4	4	1	0	1	0	0	0	0	13
5	<u>1</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>4</u>
Sub-											
Total	<u>7</u>	<u>11</u>	<u>6</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>0</u>	<u>1</u>	<u>1</u>	<u>0</u>	<u>29</u>
Total	271	83	49	55	46	9	29	6	8	1	557

An attempt was made to reconcile the types identified by King with the cultural periods of his bead sequence (Appendix 4). The collection clearly needs further study, and Table 4.4 includes only the 123 beads for which tentative dates can be assigned.

Table 4.4  
Bead Chronology by Unit and Level

Unit/ Level	Time Periods						Total
	M3	M5a	M5c	L1	L2a	L3	
1/8				3			3
9	2			10			12
10	1			3			4
11	1	1		1			3
2/1						2	2
7				1			1
8				8			8
10				7	1		8
3/2			1				1
3	1			6			7
4			2	5	1	1	9
5			1	5	1	4	11
6		1		2		3	6
7	1			2		2	5
8				1		2	3
9		1		1		1	3
11				2			2
3E/1				4			4
2		1					1
4/1					1		1
8				2			2
9		1					1
5/2					1		1
3		1		7		2	10
6/2				2			2
3				4		1	5
4		1		4		1	6
6	<u>6</u>	<u>7</u>	<u>1</u>	<u>81</u>	<u>5</u>	<u>19</u>	<u>123</u>

In general the bead dates in Unit 1 reflect a pattern consistent with the stratigraphy, although Table 4.4 suggests that there is some mixing of the lower levels. Within this limited sample, most of the later beads are in the upper levels and the earlier ones in the lower. In Unit 2 the bead dates are more consistent stratigraphically. Here the upper midden stratum in Levels 1 and 2 has two L3 beads and the L1 beads occur in the lower levels.

This appears to confirm that there is an intact late component separated by a thick clay stratum from an earlier deposit.

The bead data for Unit 3 reflect mixing. The presence of L3 beads at the lowest levels indicates that Feature 4 is probably from that time. The earlier beads present may have come from a period associated with the burials although they represent more than one of King's discrete phases.

Units 3 E and 4 both reflect chronology consistent with stratigraphic depth. Both have late beads in the upper levels and an early bead at the bottom. Units 5 and 6, in contrast, both show evidence of some mixing in the lower levels, although the dates are generally consistent with depth, i.e., early dates in the lower levels.

What is provocative about the distribution is the large number of Late Period beads in the basal levels. This is in contradiction to the radiocarbon dates and interpretation of stratigraphic integrity. For instance, in Unit 2 there are 15 (cupped) Late Period beads (ca. A.D. 1150-1500) from Levels 8 and 10 which are radiocarbon dated to A.D. 760. It is possible that the date assignments in Table 4.4 contain errors, or that these particular cupped beads may have a longer time range than King has indicated for this site. Whatever the ultimate solution, the problem emphasizes the need for a more rigorous analysis of the bead collection.

It should be noted as part of the inventory that Browne reported several "steatite" tubular beads three inches long, some unfinished (1959). The only stone bead from this investigation (206) is serpentine, 14.5 mm in diameter, 8.2 mm thick, with a perforation of 2.9 mm, from Unit 3, Level 3. Because of their temporal implications, additional description of the eight glass beads is provided in Table 4.5.

Table 4.5

Description of Glass Beads

Unit - Level	Color and Clarity	Type	Diam.
Unit 3 - 5	Copper blue, translucent	Cane	2.7
Unit 3 - 5	Copper blue, opaque	Cane	3.2
Unit 3 - 6	Cobalt blue, translucent	Cane	3.4
Unit 3 - 7	White, opaque	Cane	3.3
Unit 3 - 8	Green, translucent	Cane	3.9
Unit 5 - 3	Copper blue, translucent	Cane	2.7
Unit 5 - 3	Cobalt blue, translucent	Cane	3.1
Unit 6 - 3	Cobalt blue, translucent	Cane	3.6

It is relevant to site interpretations that all of the trade beads were found in the upper levels of Units 5 and 6 or in the superimposed refuse feature of Unit 3. Thus, their provenience does not conflict with any of the radiocarbon dates, and does not suggest any inversion or disturbance of the midden.

The sorters observed and saved numerous fractions of Olivella biplicata which King confirmed as detritus from beadmaking. The fragments were most often pieces of the body wall with or without remnants of the callus, or whole or broken parts of the callus; there were also some whole shells. The occurrence was most frequent in the levels of Units 3/3 E attributed to Feature 4, with three pieces also recovered in Unit 5, Level 3. Three of the small chalcedony bead drills also occurred in Unit 3.

Five scallop shells (Argopecten aequisulcatus), all from Unit 3 or adjacent 3 E, have a punched perforation (570-574). The largest of the group (574), at 6.2 cm, appears to have been trimmed around the edges; the others are all between 3.4 and 3.6 cm. The highly eroded fragment of Megathura sp. (565) from Unit



2, 90-100, is almost certainly part of a ring or ornament which is typical of King's M3 time period. What was first thought to be an ornament made from a bird talon (576, from Unit 1, 0 - 10 cm), proved to be instead the unmodified dorsal spine of Heterodontus francisci (California Horn Shark).

#### Miscellaneous

Nodules or rounded lumps of hematite were particularly noticed in Units 3 (654, 664) and Unit 4 (662, 663). The amount recorded in one occurrence (664) weighed 10.8 g, comprised of five or more discrete lumps. Both red and yellow ochre are known to occur in association with fused shale at Grimes Canyon (VanValkenburgh 1935:No. 73); it is possible that this was the source of both materials.

In addition to that observed on certain artifacts, one lump of asphaltum weighing 3.2 g (656) was recovered in Unit 1 at 70-80 cm. An unidentified lump of non-ferrous slag weighing 4.7 g (660) was present in the same location.

Metallic fragments which might represent either intrusions or native use in the early historical period occurred in Unit 5, Level 2 (658, 659). None is identified: 658 is crushed but appears perforated, and 659 is amorphous, deteriorated scrap. In the same Level 2 of Unit 5 is a small, thin piece of a coarse cement (655); it is very hard with dark, rounded inclusions, and resembles mixtures elsewhere in Ventura County which have been called Roman cement. The only other occurrences of modern material are tiny fragments of clear glass in Unit 1, 90-100 and Unit 3 E, 0-25 cm.

Finally, although these are not catalogued, mention is made of rounded or irregular sedimentary objects which, at first glance, appeared to resemble figurines or effigies. They seemed most abundant in Unit 3. However, on examination, most

dissolved readily in water and proved to be mud balls, a result of excavating wet clays in hot sun. Others appear to be natural concretions, at the most, manuports. They have been retained for further study.

## Chapter 5

### INTERPRETATIONS

#### Introduction

In this chapter, the data are synthesized and interpreted without repeating the detail presented in the previous sections or the appendices. The discussion is organized according to research domains, and all are focused toward the primary objectives of this investigation: to determine whether CA-VEN-110 retains its integrity, and whether it has yielded, or has the potential to yield, significant information relevant to scientific research. Another aspect of the ultimate evaluation is the value which the site may have to the cultural and religious concerns of the Native American community.

#### Chronology

The radiocarbon dates cited and discussed above are internally consistent, and demonstrate that the site was occupied at least between 960 and 1230 years B.P. By this method alone, CA-VEN-110 is contemporary with Simo'mo, and neither site overlaps the later dates obtained from Muwu. The presence of glass beads is evidence that CA-VEN-110 was also utilized into the historical period; King's bead analysis concludes that there was continuous occupation of the site from his Middle Period Phase 3 (ca. A.D. 300-700) until at least A.D. 1809. The bead type distribution is internally consistent, with the late varieties concentrated in the upper levels of Units 2, 5, and 6, and in Feature 4 of Unit 3 which is known to be intrusive into the earlier midden. CA-VEN-110, on the basis of the beads, could be contemporary with Muwu in at least the early historical period, but on the basis of present data, appears to have been initially settled much earlier. The relation to Simo'mo is clear at the early end of the span, and it is certainly possible that occupation continued there beyond the period documented by

radiocarbon, as is the case with CA-VEN-110. At least one shell bead from the surface of CA-VEN-26 is believed to be a Late (historical) type (C. King, personal communication 1985), and the great bulk of the Simo'mo collection has not been analyzed.

The artifact assemblage recovered to date is not sufficiently diagnostic to refine the occupation beyond the span outlined above. The assemblage, including bone and shell fishhooks, lanceolate and concave base projectile points, micaceous soapstone, bead drills, and even the ground stone artifacts reported by others, are all consistent within the proposed range. Other than the glass beads, there were no historical artifacts and almost no recent intrusions within a rodent-riddled deposit. On the other hand, no materials were recovered during this investigation to suggest milling stone or hunting period manifestations. The initial pollen samples included no representatives of exotic or cultivated plants.

#### Site Function

Activities which are represented in the cultural remains of CA-VEN-110 include all aspects of subsistence (procurement, processing, and consumption), lithic maintenance or final stages of production, beadmaking, burial of the dead, and systematic disposal of wastes. Some of these activities can be localized: the concentration of shell and burned rock in Unit 2 suggests cooking; the distribution of flakes implies a lithic workshop area near Units 5 and 6; and Feature 4 in Units 3 and 3 E is interpreted as a refuse deposit. Feature 3 in Unit 4, associated with an unusually flat stratigraphic level, may indicate a house floor. The two burials encountered by this excavation were in the lower stratum of Units 3 and 3 E; those recorded by earlier projects were in the general area of Unit 5. The minimum number of burials is now nine: three removed by Browne, four reburied by CSU Northridge, and the two excavated in 1985, in addition to the numerous displaced or eroded fragments reported over the years. There is only very limited evidence for ceremonial or ritual

activity in the form of one quartz crystal and possible whistle fragments. Social or trade relations beyond the site are suggested by the presence of fused shale and a certain type of chalcedony bead drill which could have come as raw material or finished products from Santa Cruz Island.

#### Subsistence

The density of shell, fish remains, and other bone - with the projectile points, fishing equipment, and artifacts related to their production or maintenance - emphasizes the role of this site within the local food economy. This density appears to be greater than that present at either CA-VEN-3 (Shisholop) or Muwu. Preliminary comparisons of faunal remains suggest that fishing supplied a greater portion of the diet at both of the beach sites, in contrast to greater reliance on shellfish at CA-VEN-110. No comparisons with Simo'mo are possible at this time.

Preliminary studies of the fish bone reveal species native to a variety of habitats including the kelp beds, shallow water, inshore surfzone, and deep water, and those which would have been captured with hook and line, spear, nets, and harpoon. The 47 identified shellfish species further indicate collecting on the outer coast, as well as within the lagoon; this trend may have accelerated in the later years. The identification of Gramineae pollens, although not species-specific at this stage, may reveal edible grasses and seeds on further analysis.

#### Seasonality

Although the mammal bones have not been analyzed, the array of fish and shellfish already includes a range of species which would have been available the year around. The otoliths, analyzed for seasonality, represent fish caught all year, with greater activity during the warm months: early summer - 4; mid

summer - 4; late summer - 9; late summer/early winter - 5; early winter - 1; early or mid winter - 1; mid winter - 1; late winter - 4; and late winter/early summer - 3. It has been suggested elsewhere that the gathering of Mytilus and other shellfish dwelling within or below the lowest tide zones might have peaked in the winter and early spring (Bloomer 1982:[10] 53-54), thereby supplementing the diet when fishing was more difficult or less productive. Other evidence for the seasonality of food resources may be forthcoming when seeds, pollens, and mammal bones are identified.

#### Ethnography

Ethnohistorical and historical research has not illuminated the identity, sequence, or relationship between Simo'mo, Muwu, and the unnamed locality known as CA-VEN-110. The name of Muwu was made known to Cabrillo in 1542. Both Muwu and Simo'mo were seemingly existing at the same, later time in the accounts of various events related to Bowers by Juan Pico (King 1976:302), or by Fernando Librado to J. P. Harrington (Hudson et al. 1977:passim). Well into the post-Mission period, both were described as places of great importance in the Chumash social, religious, and economic structure, and the names of many wots and other personages are known. However, Hudson et al. caution that the two names may have sometimes been used in a "generic" or regional sense, that they may have been interchangeable, or that the native informants may have been confused about events occurring before their own lifetime (1977:115). Mission register data do not at this time clarify the situation. The village called Caveques and described by Portola, Crespi, and Costanso in 1770, contributed 120 baptisms to Mission San Buenaventura but has been mapped farther up the Calleguas drainage. There were 179 baptisms at the same Mission from Muwu, but some of these people may have actually been natives of Simo'mo (Edberg 1982:[4]25-40).

Early descriptions do not help to discriminate among the names or places. Dr. W. L. Livingston of Oxnard removed two skulls "out

of the bank...in the same location where our excavation took place" (VanValkenburgh 1935). VanValkenburgh chose to use the name Simo'mo, referencing Kroeber's general location from a Henshaw manuscript, but he expressed his own uncertainty and used the Los Angeles Museum number, Mago [sic] Lagoon Section No. 1 (1935). Livingston, who made more than one excavation in the vicinity, described no less than six villages east of Mugu Lagoon, the largest being about two miles inland on a hillside above a spring (Wagner 1929:330) and probably Simo'mo. While the actual physical settings of the latter and Muwu are distinct and the places can be differentiated, the locations or identity of Livingston's "six sites" or VanValkenburgh's "three sites" (1935) cannot be correlated at this time with CA-VEN-110.

#### Research Questions

The analysis to be conducted under this contract was explicitly to be limited to that necessary "to determine whether the classes and quantities of materials that can be used to address questions that are important...are present" (COE 1985:7). The preliminary data and observations from this investigation are synthesized below in the form of responses to certain research questions formulated prior to the excavation (Appendix 9). While not advanced as conclusive or proven at this stage, the tentative answers are provided to illustrate the contributions which this limited study has already made, the kinds of data upon which conclusions are - or will be - made, and to identify the gaps or research needs which will be remedied by the recommendations developed in Chapter 6.

1. Was CA-VEN-110 a village ? The site meets many of the criteria most often set forth: there is a well developed midden with depth, high density, and stratigraphy; at least nine burials were present, and presumably more; there is evidence in the faunal remains for a sedentary, year around occupation; defined activity areas, hearths, a refuse disposal feature, and a potential house floor suggest an internal structure to the

settlement; and certain bead types imply the presence of high status individuals. Whether ideotechnic or ceremonial/religious artifacts are present is not clear at this time, but bird bone fragments may represent whistles, and quartz crystals were reported. Relations to people or places outside of the immediate vicinity are apparent in the presence of artifacts of fused shale and micaceous soapstone, the chalcedony bead drills which might have come from Santa Cruz Island (C. King, personal communication 1985), and ethnographic accounts which describe family relationships and migrations to Santa Cruz and Anacapa Islands (Hudson et al. 1977:14).

That these attributes are present does not negate the possibility that CA-VEN-110 was a satellite or enucleated settlement of either of its named neighbors. That it does not have a place name could mean either that it was occupied and abandoned prior to the historical or ethnographic records - a postulate untenable because of the glass beads - or that it was not recognized as a separate village. Although a full range of activities has been identified archaeologically, the inventory from this investigation is biased heavily toward the procurement of animal foods.

2. Was CA-VEN-110 contemporaneous with Simo'mo or Muwu ? The radiocarbon dates for this site are almost identical with those from the former. It is also apparent that CA-VEN-110 was continuously occupied into the early historical period. Since there is no evidence at present that Muwu was settled as early as the Middle Period, it is most likely that the primary relationship was with Simo'mo during the early part of the span represented at CA-VEN-110, and that the upper levels may be equivalent in time to the lowest strata at Muwu.

3. Was there a change in site function through time ? From the analytical and statistical studies to date, the distribution of artifact types, as opposed to density, appears to be consistent



from top to bottom, with no demonstrable shifts between classes, e.g., subsistence-related, ceremonial, exchange, etc. The major artifact groups at all levels are those related to food procurement, processing, or consumption. Both faunal remains and artifacts seem to illustrate greater density in the lower levels, but the trends are parallel, rather than reciprocal, in such activities as shellfish gathering, fishing, and hunting and are interpreted at this stage in the analysis as illustrative of the intensity of occupation rather than cultural change.

4. Was the occupation intensified on a seasonal basis ? Evidence from the preliminary study of fish remains suggests that this activity was most intense during the late summer, although at least some fish were caught during all seasons. Whether plant foods, shellfish, and mammals provided adequate food resources to maintain a stable population during the other months cannot be determined without further analysis. That the environment was favorable enough to sustain equilibrium by shifting the procurement priorities on a seasonal basis, rather than by the movement of people, is a testable proposition.

5. Was there a shift in the subsistence basis ? From the evidence of preliminary statistical analysis, it does not appear that there was a significant change in the proportion between proteins derived from shellfish and fish, for example, but there may be subtle changes demonstrable within the taxa represented. The Chione family was the predominant molluscan species at CA-VEN-110 at all times, as opposed to the Mytilus at Muwu, but there are indications that among the secondary species, there was greater use of Mytilus and Protothaca in the late period represented by the upper levels of Unit 4. It may also be possible to demonstrate the exploitation of different fish habitats or change in the fishing techniques when the fish bone is analyzed, and the relative importance through time of hunting both land and sea mammals awaits a more comprehensive faunal analysis.

6. Is the midden associated temporally or functionally with the cemetery? There are not adequate data to support conclusions about the seven burials recovered by others. The two burials from this excavation may be distinguished stratigraphically as clearly older than the deposit of Feature 4 which was superimposed. There is no present evidence that the female and child were associated with grave goods, and they either predate or are contemporary with the lower midden formation.

Three secondary-level statements were also advanced in the Research Design, and progress has been made in recovering data relevant to testing the propositions.

1. The population of Simo'mo moved to CA-VEN-110 after A.D. 1300. It is now known that settlement at CA-VEN-110 began considerably prior to A.D. 1300 and was, in fact, contemporary with the earliest levels of Simo'mo. CA-VEN-110 continued to be occupied into the historical period; it is not known when Simo'mo was abandoned, although at least one Late/historical bead type has been identified and the name is perpetuated in Mission-period ethnographic accounts. Without further information about Simo'mo, the termination of its occupation cannot be addressed.

It had been postulated that CA-VEN-110 might have been lightly or intermittently used prior to A.D. 1300, achieving its greatest population and most intense use after that time as a result of an influx from Simo'mo. However, the greatest density of faunal remains and artifacts at CA-VEN-110 seems to be in the lower levels of excavation which may be correlated to Beechert's earlier of two components. Although no temporal distinctions have been drawn thus far in artifacts other than beads, stratigraphic evidence strongly suggests that the early occupation was continuous and intense. The lower midden stratum in Unit 2 was particularly thick and dense, in contrast to the multiple, thin lenses of midden in the upper levels of the units east of the stream channel. Only in the late refuse deposit

within Units 3 and 3 E did the density approach that of the lower levels.

If CA-VEN-110 had received a major influx of population, one would predict an increase in site size. Evaluation of this expectation is hindered by the fact that at least some of the uppermost surface of the site has been lost in recent years. It is not possible from this investigation to compare the earlier vs. later horizontal extent of the site, but the stratigraphic profiles, midden analysis, presence of early period burials, and radiocarbon dates are consistent in indicating that occupation was perhaps even more intense prior to A.D. 1300. The burial practises as exemplified in the two individuals encountered during this project are not highly developed and do not evince the distinctions of status demonstrated by Martz at Simo'mo (1984).

2. The shift in population was related to environmental changes affecting Mugu Lagoon which resulted in an increasingly maritime adaptation. Preliminary study of the pollens confirms that the contemporary environment was a salt marsh, but was too limited to allow for definitive paleoenvironmental reconstruction or to demonstrate changes. It has never been established that the lagoon did in fact recede or alter its configuration substantially within the span of time represented by these villages. Descriptions of Simo'mo mention banks or stream, but without additional information, it is impossible to determine whether there might have been temporary high water or flooding or whether the investigators were working near one of the historically created channels of Calleguas Creek.

The second part of the proposition related to an increase in maritime adaptation can be tested by study of the fish and marine mammal remains from CA-VEN-110, and the distribution and evolution of technology as represented in both artifacts and the faunal remains. After the fish remains are identified and

quantified, they can be related to habitats exploited and methods of capture (Fitch 1972; Huddleston and Barker 1978), and their proportion within the total diet established with reference to land mammals, birds, shellfish, and vegetal remains. On the basis of ecofact density and the artifacts recovered to date, fishing appears to have been well established in the lowest levels of CA-VEN-110. Additional study and statistical analysis of the molluscan remains, on the other hand, may reveal a shift in secondary species which could be attributed to increasing sedimentation within the lagoon and greater effort expended in collecting on the outer beach.

Tests for the presence of pollen yielded taxa consistent with a salt marsh environment, e.g., Chenoam (includes soap plant, pigweed, goosefoot, amaranth), Tubuliflorae (includes mulefat, baccharis), Typha (cattails), and Plantago (plantain). The samples examined by Schoenwetter were too limited to permit a more definitive paleoenvironmental reconstruction. His preliminary analysis does suggest that while palynology may not be able to achieve a finer chronological control than archaeological and stratigraphic positioning, pollen samples may contribute very sensitively to the resolution of intra-site chronological problems. The evidence thus far suggests that changes in the pollen array are more likely to reflect behaviors or activities within the site than ecosystemic change.

3. CA-VEN-110 was a major provincial village. Here again, the actual location of events described as taking place at Simo'mo or Muwu cannot be established from the literature alone. The cultural materials excavated to date from CA-VEN-110 do not include the kinds or quantities of items assumed to be ceremonial or religious in nature. The two 1985 burials were apparently not accompanied by any grave goods, and although the records are skimpy, those recovered earlier were not generously endowed with offerings, if any. There is no certainty that the two projectile points or bone fishhook mentioned in 1959 were in fact associated

with the interments removed at that time, although a field sketch indicates at least a few beads in the neck region of Burial 1 (Browne 1979). The bead collection recovered in 1985 has been interpreted to imply that high status individuals were present, but this is the only evidence thus far for social stratification.

If it is interpreted as a separate, distinct village, then it is not likely that CA-VEN-110 by itself was a major provincial center. However, the coincidence in radiocarbon dates with Simo'mo and the spatial continuity in cultural remains with that site lead to the conclusion that CA-VEN-110 was a part of a major provincial village complex from the earliest days of Simo'mo.

From the 4.8 cubic meters of excavation and limited analysis of cultural materials, new information has already been provided about CA-VEN-110. Further, it is evident that data from the site have the potential to contribute to the resolution of many significant research questions relevant to the village complex at Mugu Lagoon, settlement patterns of the southern California coast, the process of maritime adaptations, internal village structure, and other regional problems which transcend the immediate site boundaries.

## 6. CONCLUSIONS

### Integrity

All lines of evidence are congruent in demonstrating that the areas tested are primary deposits which retain scientific integrity. Geomorphological examination of the overburden showed that the midden was effectively sealed by a clay stratum, and soil profiles within the cultural deposit revealed unbroken strata of sands, silts, and midden, rather than the mixing which might be expected if the material were redeposited. The posture and articulation of the two burials, as well as the articulation of the fish remains in Feature 2, are additional corroboration that they were in a primary context. Internal stratification, such as the refuse pit cut into the burials or the gravel layer interpreted as an ancient stream channel in Unit 6, is another indicator that the deposit shows the effects of change by means of either cultural behaviors or natural processes. This lack of homogeneity in both horizontal and vertical distributions is demonstrable in the midden analysis, and is contrary to what would be expected if the midden had been tumbled, mixed, or redeposited.

The technical studies support this conclusion. The radiocarbon dates are internally and stratigraphically consistent, and the monitor charcoal agrees with the bracketing shell samples. No trade beads whatever occurred in the excavation units dated; they were recovered only in the upper levels of Units 5 or 6 and in the late refuse deposit in Unit 3. Analysis of the shell beads shows a spatial and chronological distribution of types consistent with all of the interpretations. No exotic, introduced, or cultivated plants were identified in the pollen samples, and no modern refuse or flood-borne debris was present below the overburden. By all criteria that could be observed or tested, the areas studied during this investigation represent

an intact primary cultural deposit.

### Research Potential

It was not expected that this test excavation would fulfill all of the stated research objectives, but rather, it was to determine if the site contained the categories and quantities of data which would permit important scientific questions to be addressed. For each of the problems posed, either progress was made toward providing such answers, or it was demonstrated that the information was present which, upon further analysis, had the potential to test such hypotheses.

A substantial beginning has been made in establishing a chronology for CA-VEN-110 which will help in defining its role in a site complex containing its two better known, named neighbors. It is now apparent that the occupation is as old as Simo'mo and is contemporary with the latter for as long as Simo'mo existed. At the recent end of the span, CA-VEN-110 appears to overlap at least the early years of Muwu.

CA-VEN-110 meets some of the criteria of an independent village: nine known burials, a well developed midden, possible hearths and house floor, clustering of constituents which suggests activity areas, food remains indicative of all seasons, and certain beads identified as high status markers. Yet its identity must be more carefully scrutinized, especially because cultural remains have been observed continuously from Simo'mo to this site and the absence of a native place name remains an enigma in view of the historical beads. From this test, the artifact inventory and midden analysis suggest a primary function in food procurement, processing, and consumption; beadmaking and lithic maintenance are other activities present. Artifacts related to plant foods, as opposed to fishing and hunting, have been described by other investigators, but not recovered in this test. Tool diversity within the current assemblage is relatively

low; the collection lacks evidence of hard seed grinding or the manufacture of ground stone implements, there are very few primary flakes, and almost no large core tools.

Molluscan, fish, and mammal remains seem to be more abundant than at other sites with which comparisons were made. It will be possible to test for changes in function or shifts in the subsistence pattern through a combination of an expanded sample and more comprehensive analysis, both physical and statistical, of the existing and augmented collections. Since the current test has confirmed that the site is intact and contains adequate quantities and diversities of artifactual and ecofactual material, in addition to the potential for features, its research value is established. The preliminary studies of materials from this limited test have already provided important information, as well as a basis for formulating and focusing specific recommendations for the further efforts needed to satisfy the research objectives.

#### Native American Values

It would be presumptuous for the archaeological team to draw conclusions about the special concerns which the local Native American community may feel for the cultural and religious significance of CA-VEN-110. Representatives of the Candelaria American Indian Council and the southern branch of the Ventureño Chumash participated in all aspects of the field work and burial analysis, as working monitors and welcome visitors, and a statement of their position has been requested for inclusion in this report.

It is relevant for their assessment that nine burials have already been documented at CA-VEN-110. There is every possibility and likelihood that more are present; observers over the years have consistently reported seeing human skeletal remains on the surface or eroding from the banks. Given the



population estimates for Simo'mo and Muwu, it is reasonable to anticipate several large cemeteries in the general area.

### Recommendations

This test excavation has determined that CA-VEN-110 is an intact primary deposit which contains sufficient quantities and diversity of cultural remains to sustain the earlier determination that it is eligible for inclusion in the National Register of Historic Places. The information already recovered and data now known to be present confirm that the site has the potential to address broad and significant research questions at the regional level. Particularly since there has been some loss of midden by construction of the levee and channels, and perhaps some loss of the uppermost level through dredging, the primary recommendation is that all of the site now present should be preserved. The Corps has previously considered methods to preserve the site in place and has concluded that while it may be technically possible, it would be extremely expensive and probably not realistically feasible.

If the site cannot be protected against such natural forces or events as flooding and erosion, or if there is an overriding public benefit in continuing activities related to drainage, flood control, weed abatement, and maintaining or improving the channels, then a program of mitigation by means of data recovery is warranted. This investigation would include both additional field work and further analysis of the materials recovered in 1985.

The following specific measures are recommended. They incorporate and summarize the research directions offered in the appendix reports of the various consultants.

1. Testing. No further test trenches are believed necessary, in view of the auger program conducted in 1980 and the dispersed

trenching of 1985. The parameters of the intact deposit have been established to a reasonable certainty. No remains have been found easterly of the main channel of Calleguas Creek or south of the south end of the west (splitter) levee. Small isolated patches of midden have been recorded north of the main site area, which might represent secondary deposits or erosion from Simo'mo or a detached locus of CA-VEN-110. At least one such occurrence should be shovel tested to investigate integrity and association.

2. Excavation. Each of the five loci sampled in 1985 warrants additional effort. The general area of Units 1 and 2 contains the thickest midden, buried and protected by the greatest amount of overburden. The earliest radiocarbon date, one occupational feature, and absence of glass beads suggest the value of further work west of the channel; the deposit is thicker in Unit 2 than in Unit 1, and one or more new units should be excavated south of Locus 1. Each of the loci on the "island," between the west channel and Calleguas Creek, has the potential to yield valuable information through block exposures. An expansion of the area sampled in Units 3 and 3 E is needed to investigate the function, formation, and contents of Feature 4, and its relationship to the lower component. Physical and cultural stratigraphy is most apparent here. Other broad exposures between here and the south end of the site would examine the possible house floor at Unit 4, the possibility of a cemetery between Units 3 and 5, and the concentrations of faunal remains and lithic workshop debris near Units 5 and 6.

As in 1985, mechanical equipment should be used to remove the overburden, since the top of the deposit can be accurately predicted from this and previous testing. From this year's experience with water table problems in the low levels, a better strategy for keeping the unit floors drier would be to provide a sump or drain off the corner of each excavation and maintain continuous pumping once the units begin to fill.

3. Processing. Wet screening of all excavated earth should be continued, with meticulous sorting of residues. Shell should be weighed by level, but may not need to be identified to species unless there are indications that the array may be different than that reported here, or there are species-specific concentrations or features. All samples from the 1985 test have been retained, and may be sorted for purposes of intra-site comparisons. All faunal remains should be extracted from the screened residue and added to the 1985 sample for analysis.

So that the faunal, lithic, and bead studies can provide the qualitative and quantitative answers to the questions posed, it will be necessary to screen carefully selected samples through 1/16 inch mesh. Feature 4 is one area which should receive this extra care. To recover the smaller fish otoliths, selected unscreened soil samples should be provided to the consultant who will process them with 30-mesh sieves. There has been no systematic effort to retrieve small seeds and other plant remains; this should be accomplished by flotation and the results interpreted by a specialist.

4. Geology and Soils. The geomorphological study of 1985 was limited by scope, budget, and high water to an evaluation of the overburden and integrity of the contact zone. Additional effort is needed to examine and interpret the stratigraphy, soils, and deposition within the cultural deposit.

5. Beads. King has suggested the chronological range represented by the bead types, but further examination of each specimen will refine the interpretations of time and status, and implications for social and economic function. Tests should be made of his statements that 1/3 to 1/2 of the potential beads were lost by utilizing 1/8 inch screens, and that the presence of beads will correspond to the location of houses, cemeteries, and shrines.

6. Fish Remains. The collection of elasmobranch and teleost vertebrae, dentaries, spines, scutes, pharyngeals, and other parts is both large and diverse. Only the otoliths retained in the 1/8 inch mesh have been examined in detail. The abundance of teeth, jaws, and other cranial elements suggests that fish were not dismembered on the beach; that the number of otoliths is not greater at this time results from lack of fine screening and perhaps, the fact that they tend to crack and disintegrate when cooked (R. Huddleston, personal communication 1985). The range of species represented will be greatly augmented by finer screening, identification of all material collected in 1985 plus the additional samples to be recovered, and quantification of the full array is needed to document the fishing technologies used, habitats exploited, and any trends in maritime adaptation, diversity, and equitability. This study is tedious and time consuming, but regarded as highly important.

7. Lithic Artifacts and Flakes. The small size of the tertiary flakes and presence of a microdrill industry emphasize the need to use a smaller screen for volumetrically controlled samples. Another avenue for meaningful research concerns the source, extraction, chronology, and social role of fused shale. The first archaeological recording of a Grimes Canyon quarry site (Foster and Greenwood 1985) makes it possible to test the material from CA-VEN-110 against the chemical footprint of a known source. The material can then be measured for hydration by the same methods applied to obsidian. Recent studies have challenged the old assumption that presence of fused shale is a time marker for Late Horizon sites, and the artifacts and flakes from CA-VEN-110 can contribute to studies of the chronology, inherent properties, degree to which manufacturing was pursued at the ultimate destination as opposed to the quarry, postulated relationship between fused shale and status, and potentially, differential value of the colors, social controls over extraction and trade, and association of the source with important villages of the area (C. Singer, personal communication 1985). Further

study of the chalcedony cores, flakes, and microdrills can help resolve whether these artifacts were manufactured or only maintained at the site.

8. Conchology. All shell from two units, one excavated in arbitrary 10 cm levels and the other according to stratigraphic increments, has been identified to species, and the shell from all other units has been saved. Additional sorting may provide information about the contents of Feature 4 or other particular features or areas yet to be excavated. With the substantial weight of shell already identified to serve as a control, detailed study of additional units may be accomplished from volumetrically standardized samples. The next step needed to continue the analysis of the 1985 collection and any new samples is the calculation of degree and directions of change, through use of regressions and the analysis of variance. Further statistical applications would provide measures of diversity and equitability. It would be particularly useful to acquire comparative data from the Simo'mo.

9. Faunal Analysis. None of the land mammal, sea mammal, or avian bone has been identified or quantified beyond separation into gross categories. All of the 1985 collection, plus any additional material to be recovered, should be analyzed as part of the research into subsistence pattern, seasonality, and trends in comparative resource exploitation.

10. Mortuary Practises. With only the two incomplete burials from the 1985 test, there are not sufficient data to compare the cultural traditions, burial practises, and status differentiation at CA-VEN-110 with those demonstrated for Simo'mo and the other four sites studied by Martz (1984). Elsewhere, the evidence suggested that religious practises began to decline about A.D. 1100 and decreased rapidly by A.D. 1600, to be replaced by an emphasis on ascribed status in Chumash burials after A.D. 1600 (Ibid.:505). All that can be said about CA-VEN-110 at this time

is that the two burials are apparently associated with the early period of occupation, and that both - an adult female and a young child - lack associated grave goods. Dating of this interment and exposure of additional burials would be necessary to pursue this line of investigation.

11. Chronology. The radiocarbon dates are consistent for the span of occupation documented, but almost certainly do not encompass the entire occupation at CA-VEN-110. Samples could not be taken from the lowest levels of Units 1 or 2 because the excavations were flooded, and the dates do not extend into the historical period represented by the glass beads. Additional samples should be analyzed from the lowest and uppermost levels, and from horizons or features which can be interpreted as representing the older and more recent components.

12. Concerns of the Ventureño Chumash. Expressions of opinion and concurrence in these recommendations should be elicited from the local Native American community by consultation or written statements.

### Summary

The data presented in this report support the finding that CA-VEN-110 still meets the criteria by which it was determined eligible for the National Register of Historic Places. Not only were all areas tested found to be intact, but the cultural deposit is substantially deeper, thicker, more horizontally extensive, and older than originally described. The midden is unusually rich in faunal remains, even by the preliminary comparison with other sites, and presents a unique opportunity for examination of subsistence practises over an extended period of time. Another major aspect of its research potential involves the question of settlement pattern, in its relationship to the adjacent major villages which are better known.

Because of its significance, the preferred recommendation is that CA-VEN-110 be preserved against either natural or induced erosion, disturbance, and further loss of fabric. If this is not possible, such adverse impacts should be mitigated by a program of data recovery. Necessary measures would include additional excavation and more intensive analyses of the existing collection together with the new materials to be recovered.

## REFERENCES CITED

- Beechert, Ed  
1959 Field Notes, Field Class Excavation of VEN-110, Spring. Ms. on file, Los Angeles County Museum of Natural History.
- Binford, L. R.  
1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. American Antiquity 45[1]:4-20.
- Bloomer, William W.  
1982 Analysis of Shellfish Remains at LAN-229. In Archaeological Investigations at Talepop (LAN-229), Draft Report, Chester D. King, project director, vol. III, 10:1-57. Office of Public Archaeology, University of California, Santa Barbara.
- Breschini, Gary S., Trudy Haversat, and Jon Erlandson  
1983 California Radiocarbon Dates. Supplemental Edition 2.1. Coyote Press, Salinas.
- Briuer, Frederick, and Michael McIntyre  
1975 Assessment of the Archaeological Impact on Revolon-Beardsley Projects. EIR (VS-80) on file, Northridge Archaeological Research Center, California State University, Northridge.
- Browne, Robert O.  
1959 Field notes. Included in Beechert 1959.  
1974 Letter to Jim Quinn, Deputy Director of Flood Control, Ventura County Public Works Department. On file, Ventura County Flood Control District, Ventura.
- Department of the Army, Corps of Engineers (COE)  
1985 Test Excavation and Evaluation of CA-Ven-110 at Calleguas Creek, Ventura County, California. Solicitation No. DACWO9-85-R-0003. Los Angeles District.
- Edberg, Bob E.  
1982 Ethnohistoric and Historic Overview of Talepop and the Rancho Las Virgenes. In Archaeological Investigations at Talepop (LAN-229), Chester D. King, project director, vol. I, 4:1-73.



Fitch, John E.

1969 Fish Remains, Primarily Otoliths, From a Ventura, California, Chumash Village Site (VEN-3). In A Coastal Chumash Village: Excavation of Shisholop, Ventura County, California, by Roberta S. Greenwood and R. O. Browne, Appendix A, pp. 56-71. Memoirs of the Southern California Academy of Sciences vol. 8.

1972 Fish Remains, Primarily Otoliths, From a Coastal Indian Midden (SLO-2) at Diablo Cove, San Luis Obispo County, California. In 9000 Years of Prehistory at Diablo Canyon, San Luis Obispo County, California, by Roberta S. Greenwood, pp. 99-120. San Luis Obispo County Archaeological Society Occasional Paper 7.

Foster, John M., and Roberta S. Greenwood

1985 Cultural Resource Investigation: LCC/LCN 397 Project Area, Grimes Canyon, Ventura County. Greenwood and Associates. Report submitted to Resource Management Agency, County of Ventura.

Gamble, Lynn H., D. Larson, D. Bamforth, and C. King

1982 Tools and Tool Manufacturing Refuse. In Archaeological Investigations at Talepop (LAN-229), Draft Report, Chester D. King, project director, vol. II, 8:1-91. Office of Public Archaeology, University of California, Santa Barbara.

Greenwood, Roberta S.

1961 Excavations at Goleta: Part 4: Shell Analysis. In Excavations at Goleta, by M. B. McKusick, M. Kowta, S. Rootenberg, F. Curtis, R. S. Greenwood, A. T. Gilman, and B. M. Schwartz, pp. 409-422. Archaeological Survey Annual Report 1960-1961:339-463. University of California, Los Angeles.

1972 9000 Years of Prehistory at Diablo Canyon, San Luis Obispo County, California, San Luis Obispo County Archaeological Society Occasional Paper 7.

Greenwood, Roberta S., and R. O. Browne

1969 A Coastal Chumash Village: Excavation of Shisholop, Ventura County, California. Memoirs of the Southern California Academy of Sciences vol. 8.

Greenwood, Roberta S., John M. Foster, and Gwendolyn R. Romani

1985 Research Design for CA-VEN-110. Greenwood and Associates. Prepared for the Corps of Engineers, Los Angeles District.

- Hach Chemical Company  
1977 Operating Manual, Soil Test Laboratory, Model 17000.  
Ames, Iowa.
- Hausner, Don  
1975 Memorandum: History of Calleguas Creek, F2 III. Notes on  
file, Ventura County Flood Control District, Ventura.
- Heizer, Robert F.  
1949 Curved Single-piece Fishhooks of Shell and Bone in  
California. American Antiquity 15[2]:89-97.
- Heizer Robert F., and John A. Graham  
1967 A Guide to Field Methods in Archaeology, Approaches to  
the Anthropology of the Dead. The National Press, Palo  
Alto, California.
- Huddleston, Richard W., and Lloyd W. Barker  
1978 Otoliths and Other Fish Remains from the Chumash Midden  
at Rincon Point (SBa-1), Santa Barbara-Ventura Counties,  
California. Natural History Museum of Los Angeles  
County Contributions in Science no. 289.
- Hudson, Travis, Thomas Blackburn, Rosario Curletti, and Janice  
Timbrook (editors)  
1977 The Eye of the Flute. Santa Barbara Museum of Natural  
History, Santa Barbara.
- King, Chester D.  
1965 Chumash Inter-Village Economic Exchange. In Native  
Californians: A Theoretical Retrospective, edited by  
Lowell J. Bean and Thomas C. Blackburn, pp. 289-318.  
Ballena, Ramona.
- 1982 (Project Director) Archaeological Investigations at  
Talepop (LAN-220), Draft Report. Office of Public  
Archaeology, University of California, Santa Barbara.
- Kirkish, Alex  
1978 Field Notes Taken While Observing Debris Removal  
Operations at VEN-110. Ms. on file, Ventura County  
Flood Control District, Ventura.
- Landberg, Leif C. W.  
1975 Fishing Effort in the Aboriginal Fisheries of the Santa  
Barbara Region, California: An Ethnohistorical Appraisal.  
In Maritime Adaptations of the Pacific, edited by  
Richard W. Casteel and George I. Quimby, pp. 145-170.  
Mouton, The Hague and Paris.

- Love, Doris Holly  
 1979 Marine Subsistence at Muwu. *Journal of New World Archaeology* 3(2):44-57.
- 1980 Marine Subsistence at Muwu - Ven-11. Master's thesis, Department of Anthropology, University of California, Los Angeles.
- McIntyre, Michael  
 1975 Nomination form to National Register of Historic Places for Ven-110. On file, Center for Public Archaeology, California State University, Northridge.
- 1976 Letter to A.P. Stokes. On file, Center for Public Archaeology, California State University, Northridge.
- Martz, Patricia Carol  
 1984 Social Dimensions of Chumash Mortuary Populations in the Santa Monica Mountains Region. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Riverside. University Microfilms International, Ann Arbor.
- McKusick, Marshall B.  
 1959 Site Record form for Ven-110. On file, Archaeological Survey, University of California, Los Angeles.
- Pierce, C., E. Clinger, and L. Gamble  
 1982 Petrology of Chipped Stone Artifacts. In Archaeological Investigations at Talepop (LAN-229), Draft Report, Chester D. King, project director, vol. II, 7:1-7. Office of Public Archaeology, University of California, Santa Barbara.
- Raab, L. Mark, and Albert C. Goodyear  
 1984 Middle-Range Theory in Archaeology: A Critical Review of Origins and Applications. American Antiquity 49[2]:255-268.
- Resnick, Rheta  
 1980 Subsistence Patterns at VEN-11, A Coastal Chumash Village. Master's thesis, Department of Anthropology, California State University, Northridge.
- Rombauer, Irma S., and Marion Rombauer Becker  
 1980 Joy of Cooking. Bobbs-Merrill, New York.

Singer, Clay

- 1984 Stone Artifact Materials Recovered from Charmlee Park Archaeological Sites. In Archaeological Investigations at Charmlee Regional County Park CA-LAn-472, 966, 1057, and 1058, edited by L. Mark Raab, Clay Singer, and Louis Tartaglia, Appendix B:203-209. Ms. on file, Northridge Center of Public Archaeology, California State University, Northridge.

Singer, Clay, and Gwen Romani

- 1980a Systematic Archaeological Testing at Revolon Slough (CA-VEN-110), Ventura County, California. EIR (VS-80) on file, Northridge Archaeological Research Center, California State University, Northridge.
- 1980b Archaeological Testing at CA-VEN-110, Calleguas Creek, Ventura County, California. EIR (VS-80) on file, Northridge Archaeological Research Center, California State University, Northridge.

Steffen, Lyle J.

- 1982 Mugu Lagoon and its Tributaries: Geology and Sedimentation. Report on file, U.S. Department of Agriculture, Soil Conservation Service, Watershed Planning Staff, Davis.

Strudwick, Ivan

- 1985 The Single-Piece Circular Fishhook: Classification and Chronology. Pacific Coast Archaeological Society Quarterly 21(2):32-69.

United States Department of Agriculture, Soil Conservation Office (USDA)

- 1983 Environmental Assessment, Revolon Slough Outlet, Ventura County, California. Report on file, U.S. Department of Agriculture, Soil Conservation Service, Davis.

Van Bergen, C.

- n.d. Excavations at Point Mugu. Ms. (1932) on file, Los Angeles County Museum of Natural History.

VanValkenburgh, Richard

- 1933 Letter to "Joe." On file, Natural History Museum of Los Angeles County. Contained in Notes on the Ethnography... (1935) cited below.
- 1935 Notes on the Ethnography and Archaeology of the Ventureno Chumash. Unpublished ms., transcribed from microfilm on file at the Smithsonian Institution (6042-Archaeology of California). Washington, D. C.

- Wagner Henry R.  
 1929 Spanish Voyages to the Northwest Coast of American in the Sixteenth Century. California Historical Society, San Francisco.
- Warne, John E.  
 1966 Paleoecological Aspects of the Recent Ecology of Mugu Lagoon, California. Unpublished Ph.D. dissertation, Department of Geology, University of California, Los Angeles.
- West, G. James  
 1979 The Archeology of Ven-100. California Archaeological Reports No. 17. State of California, Department of Parks and Recreation, Sacramento.

#### Individuals Consulted

- Lockhart, William. Biologist, Ventura County Flood Control District
- McLean, James H. Curator of Invertebrate Zoology, Los Angeles County Museum of Natural History.
- Rozaire, Charles A. Curator of Archaeology, Los Angeles Museum of Natural History.
- Schwartz, Steven. Corps of Engineers, Los Angeles District.
- Singer, Clay A. Lithic specialist, Santa Monica.
- Stipp, Jerry F. Co-director, Beta Analytic Inc., Coral Gables, Florida.
- Swift, Camm. Curator of Ichthyology, Los Angeles Museum of Natural History.

## APPENDIX 1

### GEOMORPHOLOGICAL INVESTIGATIONS AT VEN-110, VENTURA COUNTY, CALIFORNIA

by Tony Morgan

#### 1.0 INTRODUCTION AND PURPOSE OF INVESTIGATION

Cultural resource investigations at site VEN-110 were conducted to determine if sufficient site integrity existed to require mitigative actions. Test excavations with a backhoe revealed midden deposit(s) 1 to 3 m below the modern ground surface. The midden deposit, based on the backhoe exposures, appeared to be laterally discontinuous. The primary goal of the geomorphological investigations was to determine if the geomorphic information contained in the sediments could be used to provide an assessment of site integrity. Additionally, if the site is sufficiently intact to warrant mitigative action, then what data can be gained from the test excavations to provide answers or working hypotheses for the following questions that may be useful in preparation of research designs for the mitigative actions.

The question of site integrity can be addressed by examining the deposits overlying the strata containing cultural materials. The presence of a laterally continuous stratum with a conformable contact between it and the underlying stratum would infer a high potential for site integrity. Geometric stratigraphic relationships may also be used to assess site integrity. A deposit that is laterally truncated by overlying strata implies an unconformable contact and therefore probable erosion of underlying deposits.

Secondary questions for which important data may be gained from the test excavations include:

1. Why did the physical characteristics of the midden deposit change?

Lateral changes in midden characteristics are not totally addressable by geomorphic parameters. Cultural imprints on the natural stratigraphy are important modifiers of the deposit's characteristics (e.g.,

sedimentological features). It is possible, given the proper conditions, to use the stratigraphic context of the midden deposit and the sedimentological features of adjacent strata to infer changes in the depositional environment that may have influenced site usage.

2. What was the depositional environment, based on sedimentological parameters, at the site during occupation?

Depositional environments can be approximated by the grain size distribution and composition of the deposits and recognition of sedimentological features. However, this data must be interpreted based on the observed characteristics of the deposits and with full awareness of the limitations of the data and current analytical restrictions (Gladfelter, 1985, p.42).

3. Can the sedimentological record provide any data to temporally restrict the time of site occupation?

It is possible, given the proper conditions, to determine sedimentation rates for discrete sediment intervals and to extrapolate those rates to the strata of interest. However, this technique has several limitations and should be used in conjunction with cultural chronologic constraints.

The remainder of this report provides information on the general geologic and geomorphic setting of VEN-110 as well as interpretations and observations for the sediment sequences examined in the field. Descriptions of stratigraphic units identified in the field are provided in Section 2.0 and Appendix A. Interpretations of the stratigraphic sequences and comparisons with previous research in the area are contained in Sections 3.0 and 4.0, respectively. Section 5.0 discusses the implications of the observations gained from this investigation for future cultural resource investigations and Section 6.0 provides some suggestions for future research. Section 7.0 provides a summary of the results.

### **1.1 Geographic Location**

Site VEN-110 is located just north and east of the Las Posas Road and the Pacific Coast Highway intersection in southeast Ventura County, California. Point Mugu Naval Air Station is south of the site with the western portion of the Santa Monica Mountains forming a major physiographic boundary less than 0.5 km to the east. Oxnard, California is located about 8 km west of the site. The Oxnard Plain extends north from the site with Mugu Lagoon occupying positions nearer the coast. Calleguas Creek flows on the eastern side of VEN-110. Field investigations for this study occurred within modern channelized portions of Calleguas Creek.

### **1.2 Geologic Setting**

The regional geologic setting for southern Ventura County is presented in Weber (1973). A detailed discussion of the evolution of Ventura Basin and the surrounding terrain is not required for this study. An adequate synopsis of the evolutionary sequence is contained in Steffen (1982) or Weber (1973) and does not require repetition in this document. Site VEN-110 is located in an area mapped as late Pleistocene and possibly Holocene silty and clayey deltaic deposits of the Oxnard Plain. The area immediately adjacent to Calleguas Creek is denoted as late Pleistocene or Holocene sand and gravel deposits. Areas on Point Mugu Naval Air Station nearer to the coast have been mapped as Pleistocene lagoonal deposits. Beach and sand dune deposits occupy the coastline. Portions of the Santa Monica Mountains near the site are delineated as marine, Tertiary-age Topanga Formation with lesser amounts of the Tertiary Conejo volcanics.

### **1.3 Local Geomorphology**

Putnam (1942) described the geomorphology of the area north of Ventura, California, but did not extend his study area out onto the Oxnard Plain. Currently, the geomorphic evolution of the Ventura Basin is receiving a significant amount of scientific attention by individuals (e.g., Clark, 1982;



Rockwell, 1984) interested in the influence of Quaternary tectonics on landscape evolution. Unfortunately, this scientific interest has also been centered on the northern portions of the basin. Overall, very little modern geomorphological research has been done in the southern part of the county.

The Oxnard Plain slopes to the southwest at about 1 m/km near VEN-110. Runoff from the more mountainous terrains to the north and more inland portions of Ventura Basin drain across the Oxnard Plain to the ocean. The lower portion of Calleguas Creek is the drainage outlet for the Beardsley Wash, Revolon Slough, and Calleguas Creek watersheds (Steffen, 1982, p.6). A desire for increased flood control on Calleguas Creek as it crossed the Oxnard Plain led to levee construction in 1884 (Steffen, 1982, p.20).

## **2.0 DESCRIPTION OF STRATIGRAPHY**

Overall, the site stratigraphy consisted of silt loams and sandy loams unconformably overlying silty clays and clays. Numerous unconformities were observed within the upper sandier deposits. Locally, the contact between the sandier strata and siltier strata was marked by an accumulation of gravel (up to 3 cm diameter), shells, and coarse sand. Unconformities were less common in the finer-grained deposits.

### **2.1 Stratum Descriptions**

Two backhoe trenches were examined in detail to develop an understanding of the stratigraphic context of prehistoric cultural materials found at VEN-110. Detailed stratigraphy drawings (Figure 2-1 and 2-2) were keyed to stratigraphic unit descriptions (Appendix A) for the two backhoe excavations.

Each stratum identified in the field was assigned a unique number. The youngest sediments, in general, receive the lowest numbers, oldest sediments the largest. Major changes in depositional environments (e.g., eolian, fluvial, lacustrine) are designated by changing the identification number by 10. For example, a sequence consisting of eolian sands overlying lacustrine

silts, which in turn overlies fluvial gravels would receive the following designations:

eolian sands	10's
lacustrine silts	20's
fluvial gravels	30's

Each of the major sediment types is termed a depositional set. Subdivisions within each major sediment type would be labelled 11, 12, 21, 22.1, 22.2, 31, 32.1, 32.1.1, 32.1.2, 33, and so forth, depending on the complexity of the local stratigraphy. At no time are the numbers which are even multiples of 10 (e.g., 10, 20, 30) used as strata identification numbers. These numbers are reserved for use in discussing the overall stratigraphic setting (e.g., fluvial versus eolian).

The following is a brief description of the major depositional sets identified in the field which were important to understanding the stratigraphic context of prehistoric cultural materials found at the site. These descriptions were compiled from Trenches 1 and 6. Detailed descriptions are provided on the Stratigraphic Unit Description sheets contained in Appendix A.

The sedimentological sequences revealed in the backhoe trenches indicate a major shift in the dominant surficial processes active in the vicinity of VEN-110. The near surface sediments are sandier than those in which the cultural material was recovered. Starting at the top of the backhoe excavations, the near surface sediments are fluvial silts and sands (depositional sets 10 and 20). Very recent ground disturbance, presumably man-made, was found in some localities. Eolian reworking of the surface layers is also likely based on the grain size distribution of the deposit. Depositional set 20 appears to be stratigraphically adjacent to depositional set 30 (Figures 2-1 and 2-2), but some strata within depositional set 20 overlap strata assigned to depositional set 30. Depositional set 30 is not a laterally continuous stratigraphic unit. Generally this depositional set is composed of coarse sands, gravels (up to 3 cm in diameter), and shell fragments. Depositional set 40 appears to

represent a transition between sets 30 and 50 as it displays some of the sedimentological characteristics of the adjacent depositional sets. The silts and clays of depositional set 50 were the oldest stratigraphic unit examined in the field and contained the midden deposits.

## **2.2 Stratigraphic Profile Descriptions**

Basic descriptions of strata identified in the field are provided below. These descriptions emphasize textural characteristics, colors, bedding, and any special features that were unique to the stratum. Detailed descriptions are provided on the Stratigraphic Unit Description sheets contained in Appendix A.

### **Stratum 11**

Texture: sandy loam  
Moist color: 10YR5/3  
Bedding: none observed  
Historically disturbed stratum.

### **Stratum 12**

Texture: sandy loam  
Moist color: 10YR5/3  
Bedding: thinly laminated, continuous, parallel beds  
Historically disturbed stratum.

### **Stratum 21**

Texture: silt loam  
Moist color: 10YR3/2  
Bedding: none observed  
Darker, more organic stratum.

Stratum 22

Texture: sandy loam  
Moist color: 10YR6/4  
Bedding: none observed

Stratum 23

Texture: sandy loam  
Moist color: 10YR5/3  
Bedding: none observed

Stratum 24

Texture: silt loam  
Moist color: 10YR4/2  
Bedding: none observed

Stratum 25

Texture: sandy loam  
Moist color: 10YR5/3  
Bedding: none observed

Stratum 31.1

Texture: sandy loam  
Moist color: 10YR3/2  
Bedding: none observed

Stratum 31.2

Texture: silt loam  
Moist color: 10YR3/2  
Bedding: none observed

Stratum 32

Texture: sandy loam  
Moist color: 10YR4/2  
Bedding: none observed

Stratum 33

Texture: loam  
Moist color: 10YR4/2  
Bedding: none observed

Darker colored, more organic stratum; visible organic debris.

Stratum 34

Texture: sandy loam  
Moist color: 10YR6-7/3  
Bedding: thinly laminated, continuous, parallel beds

Stratum 35

Texture: sandy loam  
Moist color: 10YR4/2  
Bedding: none observed

Weak organic stratum.

Stratum 36

Texture: sandy loam  
Moist color: 10YR6-7/3  
Bedding: none observed

Stratum 37

Texture: sandy loam  
Moist color: 10YR6/4  
Bedding: none observed

Gravel accumulations (visual estimate -1%) along basal contact; few > 2 cm,  
most < .1cm.

Stratum 41

Texture: loam  
Moist color: 10YR6/4  
Bedding: none observed

Stratum 51

Texture: silty clay to clay  
Moist color: 10YR4/3  
Bedding: none observed

### 3.0 INTERPRETATION OF STRATIGRAPHY

#### 3.1 Trench 1

The lowest stratigraphic units examined for this investigation (depositional set 50) suggest that the ground was periodically inundated by shallow water or at least moist much of the time. The moist ground conditions would have supported substantial vegetation growth near the site and this growth may have destroyed any bedding in the silts and clays. Waning phases of the lacustrine-like sediment deposition are marked by the deposition of stratum 51. Stratum 51 appears to mantle the deeper cultural material bearing stratum. The depositional environment slowly began to change to a more high energy fluvial condition as evidenced by the presence of stratum 41 loam, which is thought to represent a transition between the lacustrine and fluvial conditions.

At this point in the stratigraphic sequence the depositional environment changes to more high energy fluvial conditions. The coarse sands and gravels of stratum 37 document higher velocity flow of water across the site. The other strata contained within depositional set 30 record the episodic deposition of sand and silt (strata 31.2, 33, 35) and intervening periods of nondeposition (strata 31.1, 32, 34, 36). Periods of nondeposition are recorded in the stratigraphy by a darker colored, less sandy stratum. Occasionally, organic debris is visible in these strata. In situ styrofoam

fragments were found in stratum 31.2.

Depositional set 20 laterally truncates several of the strata in depositional set 30, thereby attesting to its younger age. The point of intersection of depositional sets 20 and 30 was somewhat ambiguous in the field. Sedimentologically, depositional sets 20 and 30 are identical; the same surficial processes are responsible of deposition of these sediments. It is interesting to observe that strata in depositional set 30 slope to the east, while strata in depositional set 20 slope to the west. It is possible that depositional set 20 was deposited in a channel that paralleled Calleguas Creek, but this cannot be proved or disproved based on the currently available data.

Depositional set 10 contains the most recent deposits. Stratum 11 has been reworked and is loose without any observable bedding. Stratum 12 appears to be in situ based on the thinly laminated, continuous parallel bedding.

### 3.2 Trench 6

Trench 6 shows a similar stratigraphic sequence to Trench 1: fluvial silts and sands of depositional set 30 overlying depositional set 50. The major difference between the stratigraphic sequences is the absence of depositional set 40 in Trench 6 and the presence of some bedding within stratum 51. Overall, the sedimentological characteristics of deposits did allow correlation with strata in Trench 1. A trough-shaped feature exists in the trench wall and is totally contained within strata 33? and 36 (Figure 2-2), so it is believed to be a local feature. The thickness of depositional set 30 averaged about 50 cm compared to nearly 65 cm in Trench 1. It is not known whether this difference reflects a lack of deposition, post-depositional removal of the deposit, man-made alteration of the sediment thicknesses, or a combination of all or any of the above.

### 3.3 General observations

This section presents general observations made in the field that are critical to developing working hypotheses that can be used to develop research designs aimed at answering the questions posed in Section 1.0.

#### General Observations:

- o Examination of the trenches available for this phase of the investigation revealed that the midden deposits thinned to the east and south;
- o The loamy sediments (stratum 41) marking the transition between the lacustrine-like deposits and the fluvial silts and sands was thickest in the western trenches and not present in the eastern-most trenches;
- o Large gravel is found in the fluvial deposits only in the trenches closest to the modern position of Calleguas Creek (the eastern-most trench);
- o The contact between the upper sandier deposits and the lower siltier deposits is unconformable. Consequently, a period of erosion is suggested by the presence of the unconformity.

These observations suggest the following as a working hypothesis for understanding the site stratigraphy and are useful for developing research questions for any future mitigative actions. Figure 3-1 displays a schematic cross-section of the site depicting the spatial relationships of the midden and other deposits. Sedimentological conditions in the trenches suggest Calleguas Creek channel has assumed a geographic position east of the backhoe trenches during the times since occupation of the site by aboriginal groups. The presence of gravels in trenches nearest the modern Calleguas Creek channel indicates the velocity of water was higher at this point than at any of the other backhoe trenches. Trenches located the greatest distance from the modern channel position (e.g., Trench 1) contain the thickest accumulation of



stratum 41 and while stratum 41 is not found in trenches nearer the channel. Post-depositional modification of the silts by more rapid flow conditions has stripped the silts from along the depositional set 30/50 contact in areas nearer the channel and only sporadically for areas further from the channel.

These stratigraphic relationships suggest that the portions of the midden deposit nearer the creek channel were eroded by flood waters, as is evidenced by the partial truncation of the midden in Trench 6 and its absence at Trench 9. Additionally, the greatest thickness of midden deposit occurs near the backhoe trenches the greatest distance from the modern creek. Consequently, it appears an area of high ground was located closer to the modern position of Revolon Slough than Calleguas Creek.

To provide an upper time boundary on the period of site occupation, it would be advantageous to tie the change in depositional environment from lacustrine to higher energy fluvial flow into a temporal framework. This would provide a time datum for use in cultural resource investigations as well as geomorphic interpretations of landscape evolution. Observations at the trenches revealed as much as 1.5 m of silty sands overlying the *finer-grained* deposits.

Hypotheses for the origin of the depositional set 10 and 20 include:

- o The sediment has accumulated since the construction of the levees. Discontinuities found within the deposits would therefore be the result of natural fluvial forces that periodically deposit and erode sediment from the channel during flood events. Organic accumulations found along many unconformities represent accumulations between flood events during periods of relative landscape stability. Evidence supporting this hypothesis includes the presence of in situ styrofoam fragments about 50 cm below the modern ground surface, and the radical shift in fluvial conditions recorded in the stratigraphy (change from shallow, quiet water to rapid, fluvial action). Net sedimentation rates on the order of 150 cm/100 years would be required to develop the sediment thicknesses recorded at VEN-110.

- o The depositional set represents the accumulation of sediment since the retreat of lagoonal (marsh) conditions from the site location. This hypothesis suggests that the upper portion of depositional set 10 has been reworked during episodic flood events and man-made changes (e.g., dredging, removal of sand to increase channel capacity, increased silt and sand deposition due the channelization of flow). This hypothesis has strengths in that the entire thickness of the deposits does not have to originate during the past century. This hypothesis allows for the incorporation of late Holocene and historic deposits into the overall evolution of the landscape. Under this hypothesis, basal strata in depositional set 20 and 30 may have been deposited in the late Holocene with the upper strata deposited during historic times.

#### **4.0 COMPARISON WITH PREVIOUS RESEARCH**

This section provides a brief overview of other research pertinent to this investigation. The discussion is separated into subsections which are specifically keyed to the fundamental questions identified in Section 1.0. The geomorphic parameters or investigative tools most useful to answering the questions posed in Section 1.0 deal with sedimentological characteristics of the deposits. The sedimentological characteristics with the most potential for providing information useful for answering the questions posed in Section 1.0 deal with sedimentation rates and sedimentological structures.

##### **4.1 Sedimentation rates**

Warne (1971) and Steffen (1982) offer discussions on sedimentation rates for the areas near VEN-110, but with entirely different research questions and areas of concentrated study. Warne (1971) focuses on the physiographic development, sediments, and flora and fauna in Mugu Lagoon, California. Steffen (1982) presents a moderately detailed discussion on the rates and volumes of erosion and sediment yield in tributary watersheds (Revolon Slough, Beardsley Wash, and Calleguas Creek) to Mugu Lagoon and was particularly

concerned with the effects of the 1980 storm that breached the levees of Calleguas and Revolon creeks.

Sedimentation rates for the sedimentary environments near Mugu Lagoon range from 20 cm/100 yrs to 100 cm/100 yrs (Warne, 1971, p.51). The lowest values occur in the high marsh areas that lie just inland from the lagoon with the highest rates occurring in the subtidal pond behind the barrier sand. These sedimentation rates vary dramatically over very short lateral distances and it is only with the utmost caution should values obtained from an individual exposure be used to extrapolate sedimentation rates at other localities. Additionally, the values provided by Warne (1971) are time-averaged rates. The rates represent the accumulation of sediment over the last 100 years (?) and do not show the pulses of sedimentation into the lagoon that commonly occur during storm events.

Steffen (1982, p.32) reports that approximately 78,620 tons of sediment pass through the Beardsley Wash and Revolon Slough watersheds, but does not present data for Calleguas Creek watershed. However, Steffen (1982) does offer the qualitative comment that Calleguas Creek watershed generates about 80 percent of the total sediment in the tributary watersheds to Mugu Lagoon.

Analyses conducted by Steffen (1982, p.39) on the effects of the major 1980 storm event, emphasize the importance of high magnitude, low frequency surficial processes in modifying the landscape. An estimated 325,000 tons of sediment were deposited in "lower channels" of Calleguas Creek during the storm (Steffen 1982, p.41), although no direct measurements were taken (Steffen, 1982, p.43). Deposition in Calleguas Creek channel began about four miles upstream from Highway 1 (Steffen, 1982, p.42). Site VEN-110 is about one mile upstream from Mugu Lagoon so the entire length of "lower channel" is presumably the sum of the distance from where deposition began (four miles upstream from Highway 1) to Mugu Lagoon (one mile down stream from Highway 1). Evenly distributing the 325,000 tons of sediment within Calleguas Creek channel results in an average accumulation of 1.23 ft (37 cm) to 1.75 ft (53 cm; Table 4-1) for this storm event. The length of the storm was about 17

hours. Sedimentation rates for this storm event then ranged from 1.9 to 3.1 cm/hour. These rates are extremely high and serve to illustrate how a single high magnitude event can mask the long term trends.

#### **4.2 Sedimentological features**

Unfortunately, the primary references on the area around VEN-110 do not offer much information about sedimentological features of the Quaternary deposits. Warne (1971,p.48) notes that almost all traces of bedding are destroyed in the upper marsh areas due to thick vegetal growth and low sedimentation rates. Steffen (1982) did not present any data on the sedimentological features, nor were features discussed by Weber (1973).

### **5.0 IMPLICATIONS FOR CULTURAL RESOURCE INVESTIGATIONS**

#### **5.1 Site integrity**

The primary question posed in Section 1.0 deals with the integrity of VEN-110. Site integrity should be considered in past, present, and future temporal frameworks. Past breaches of site integrity can be inferred from the stratigraphic record at the site. Stratigraphic evidence from the backhoe excavations suggests that a major portion of the site remains buried under 1 to 1.5 m of alluvial silts and sands and nearly 1 m of dense clay and silt. Midden deposits located in the test excavation units near Trench 1 were stratigraphically bounded by clay and silt deposits, attesting to the in situ condition of the midden deposits. At Trench 1, the unconformable contact between the clay and silt deposits and overlying silts and sands indicates erosion of the clay and silt overlying the midden deposits, not the midden deposits. At Trench 6 midden deposits are unconformably overlain by the alluvial silts and sands, thereby denoting direct erosion of a portion of the midden deposit. The lack of midden deposits in the easternmost trench (Trench 9) suggests either total removal by fluvial actions or lack of site formation in that area, although the presence of fluvial gravels in Trench 9 indicates the highest water velocity of water was attained nearer to Trench 9 than

#### Trench 1.

The fluvial silts and sands of depositional set 30 display distinct bedding that was correlative with strata in several of the backhoe trenches. The presence of this in situ sedimentologic structure indicates these strata have not been extensively disturbed since deposition. Consequently, it appears the site has not been disturbed by surficial processes since the initiation of deposition of depositional set 30.

An assessment of the potential for compromising the integrity of VEN-110 can be derived from understanding the mechanisms likely to initiate the removal of the protective sediment cover. For site VEN-110, two mechanisms, fluvial erosion and man, are recognized as being the erosional agents with the most potential for affecting the site. Modern flood waters, channelized by levees constructed along Calleguas Creek, have the potential to erode through the protective cover of silts and sands and into the midden deposits. This is a possible scenario, however it is unlikely. Steffen (1982) states the area along Calleguas Creek near VEN-110 was a zone of deposition during the major 1980 storm event. Consequently, if the observations and assumptions presented by Steffen (1982) are correct, then the stretch of Calleguas Creek near VEN-110 can expect further deposition from subsequent major storm events.

Flood channel maintenance activities, particularly sand excavation, pose the most direct and immediate threat to site integrity. The easternmost portions of the midden deposits lie only about 1 m below the modern ground surface and could be disturbed by extensive sand excavation procedures.

Potential impacts to the site in the future stem mostly from man-induced modifications to natural surficial processes. Sand removal operations near VEN-110 could remove the protective cover of sediments and thereby increase the likelihood of site disturbance. Additionally, reappraisal of the susceptibility of VEN-110 to fluvial erosion should be done if major modifications are made to the flood control channels and debris basins draining through Calleguas Creek. Modifications to the channel geometry could

alter flow velocity and conceivably change the area near VEN-110 from a depositional zone to an erosional zone. The construction of a large number of debris basins upstream of the site would serve to trap the sediments that are deposited over the site as a protective cover. Removal of the sediment load from the stream could serve to increase its erosive abilities in the area near the site and pose a greater threat to continued site preservation.

It was proposed in Section 2.0 that depositional set 20 may have been deposited by a channel other than that responsible for depositional set 30. Field investigations indicate the maximum thicknesses of midden located to date are near the intersection of the depositional sets 20 and 30. It is feasible that lateral truncation of the midden deposits by adjacent channels flowing parallel to Calleguas Creek could have been repeated by channel(s) west of VEN-110, however, this hypothesis has not been tested. If the hypothesis of lateral erosion on the east and west flanks of the site is valid, then it becomes important to identify the areas near the intersection of depositional sets 20 and 30. Such areas would represent topographic positions far enough from the channels to avoid the high velocity (highly erosive) fluvial flow.

## **5.2 Time of site occupation**

The primary mechanism by which this investigation could provide data pertinent to this question is by determining the time when the environmental conditions changed from lacustrine to fluvial. Unfortunately, the data base for making this interpretation is inadequate to draw a definitive conclusion. Two major hypotheses are given in Section 3.0, but which of the hypotheses is correct, if either, is unknown.

### 5.3 Depositional environments

Field investigations at VEN-110 did not produce data useful in determining sedimentation rates for any of the stratigraphic units. A review of the literature did reveal that the sedimentation rates offered by other researchers are not applicable to a site in this particular topographic position.

Qualitatively, it is possible to conclude that the silts and clays bounding the midden deposits (e.g., as at Trench 1) were deposited in a quiet water environment. It is likely the site was periodically inundated or at least moist much of the year. The lack of bedding in depositional set 50 may be due to a moderately heavy vegetation cover destroying the bedding. Bedding in depositional set 50 is conspicuously absent and may have been destroyed by a root networks associated with heavy vegetative cover.

### 6.0 SUGGESTIONS FOR FURTHER RESEARCH

Future research at VEN-110 could help answer some of the questions originating from this investigation. The following activities are proposed to provide the data necessary to answer those questions:

- o There is a suggestion that the location of the thickest midden deposits may be spatially related to the areal distribution of overlying deposits and the thickness of the lacustrine deposits. It is suggested that a contour map of the top of the lacustrine deposits and an isopach map of the thickness of lacustrine deposits be constructed from a program of auger borings. Compare the topographic position of currently defined midden deposits to their positions beneath the top of depositional set 50 and look in other areas with the same thickness and elevation conditions.

- o Establish a program of grain size analyses to detect subtle trends in depositional sequences. The sampling program should incorporate a sampling strategy that will generate the samples required for identifying depositional events or trends and/or cultural inventory purposes. The samples should be analyzed for subtle changes in various grain size components.
- o During the mitigation phase, a series of samples suitable for radiocarbon dating should be extracted and analyzed to provide an absolute temporal framework for establishing a time of site occupation. In the absence of favorable materials (e.g., wood, charcoal) it is suggested that bulk samples of the deposits be analyzed to determine a mean residence time for the organic carbon. These dates will not provide a definitive time of deposition of the sediment, but will allow a minimum age to be offered (the sediments are at least x years old). Ultimately, it would be useful to integrate the radiocarbon dates and grain size data to determine approximate times of changes in fluvial regimes.
- o Engage the services of a geomorphologist to help evaluate the stratigraphic setting of cultural materials and to provide interpretation of the evolution of the landscape. This person should assume a major role in the development of an augering and sampling strategy.

## 7.0 SUMMARY OF INVESTIGATIONS

Major conclusions derived from this investigation include:

- o The integrity of VEN-110 has already been partially comprised as evidenced by the lateral truncation of midden deposits by fluvial silts and sands near Trench 6 and the total lack of midden deposits near Trench 9.



- o In situ cultural deposits do remain at VEN-110. The amount of protection afforded the cultural deposits by the overlying sediments varies from about 2 m near Trench 1 to less than 1 m near Trench 6.
- o Generally, the degree of site integrity decreases from west to east; the best site preservation near Trench 1, total absence of midden deposits at Trench 9. Midden deposits found near Trench 1 are separated from the fluvially deposited sediments by approximately 1 meter of silt and clay (strata 41 and 51). The presence of this "buffering layer" has served to help preserve a portion of the site from subsequent erosion. Further site protection is afforded by the more recently deposited fluvial silts and sands.
- o Stratigraphic relationships at Trenches 6 and 9 indicate the midden deposit has been truncated by fluvial action. At Trench 6, the "buffering layer" overlying the midden is thinner (20-30 cm) and at Trench 9 the "buffering layer" and the underlying midden are not present. Presumably the midden has been eroded away by subsequent flood waters.
- o Removal of the fluvial silts and sands will directly expose the midden deposit to subsequent flood waters and further compromise site integrity. The midden is most likely to be exposed in the area between Trenches 6 and 9, and in addition, removal of the silts and sands will leave only 20-30 cm of sediment overlying midden deposits in the vicinity of Trench 6.

## 8.0 REFERENCES

- Clark, M.N., 1982, Tectonic geomorphology and neotectonics of the Ojai valley and upper Ventura River: Unpublished M.A. thesis, University of California, Santa Barbara, 77p.
- Gladfelter, Bruce G., 1985, On the interpretation of archaeological sites in alluvial settings in Archaeological Sediments in Context (Julie K. Stein and William R. Farrand, eds.), Center for the Study of Early Man, Institute for Quaternary Studies, University of Maine at Orono, p.41-52.
- Putnam, William C., 1942, Geomorphology of the Ventura region, California: Geological Society of America Bulletin, vol. 53, p. 691-754.
- Rockwell, Thomas Kent, 1984, Soil chronology, geology, and neotectonics of the north central Ventura Basin, California: Ph.D. dissertation, University of California, Santa Barbara, 424p.
- Steffen, Lyle J., 1982, Mugu Lagoon and its tributaries: Geology and sedimentation: USDA Soil Conservation Service, Watershed Planning Staff, Davis, California, 73p.
- Warne, John E., 1971, Paleoecological aspects of a modern coastal lagoon: University of California Press, Berkeley and Los Angeles, 110p.
- Weber, Jr., Harold, Cleveland, George B., Kahle, James E., Kiessling, Edmund F., Miller, Russell V., Mills, Michael F., Morton, Douglas M., Cilweck, Blase A., 1973, Geology and mineral resources study of southern Ventura County, California: California Division of Mines and Geology, Preliminary Report 14, 102p.

# STRATIGRAPHIC UNIT DESCRIPTIONS

Project	Unit ID	Client	1	R	Sec	Page	1/4 of	1/4 of
Site ID	Ver-110	Trench 1				2		1/4
Described by	AK	9 July 85						
Depth range	11	21.0	23	24	25	31.1	31.2 (10) (3)	
Horizon ID	10YR 5/3	10YR 3/2	10YR 5/3	10YR 4/2	10YR 5/3	10YR 3/2	10YR 3/2	
Moist color	10YR 6/4	NA	NA	NA	NA	NA	NA	
Dry color	NA	NA	NA	NA	NA	NA	NA	
Abundance	NA	NA	NA	NA	NA	NA	NA	
Size	NA	NA	NA	NA	NA	NA	NA	
Texture	SL	SL	SL	SL	SL	SL	SL	
Sorting	MOD	MOD	MOD	MOD	MOD	MOD	MOD	
% sand	70	70	70	70	70	70	70	
Size range	CLAY → F. SAND	CLAY → F. SAND	CLAY → F. SAND	CLAY → F. SAND	CLAY → F. SAND	CLAY → F. SAND	CLAY → F. SAND	
Mean size	F. SAND	F. SAND	F. SAND	F. SAND	F. SAND	F. SAND	F. SAND	
% > 2mm	0	0	0	0	0	0	0	
% > 4mm	0	0	0	0	0	0	0	
Grain roundness	SA → SR	SA → SR	SA → SA	SA → SR	SA → SR	SA → SR	SA → SR	
Grain spheric	SP → S	SP → S	SP → S	SP → S	SP → S	SP → S	SP → S	
% Dark minis	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Bedding								
Thickness	THIN LAM	NA	NA	NA	NA	NA	NA	
Continuity	CONTIN	NA	NA	NA	NA	NA	NA	
Convolution	PARALLEL	NA	NA	NA	NA	NA	NA	
Consistence	DLO	DLO	MLO	MLO	MLO	MLO	MLO	
Fluorescence	NA	NA	NA	NA	NA	NA	NA	
Cal(13) stage	NA	NA	NA	NA	NA	NA	NA	
Boundary								
Waviness	W	W	W	W	W	W	W	
Distinctness	G	A	A	A	A	A	A	

Comments: (1) ORGANIC LAYER (2) VISIBLE ORGANIC DEBRIS (3) CONTAINED IN SITU STRATIGRAPHIC FRAGMENT

NA - NOT RECORDED NA - NOT APPLICABLE

# STRATIGRAPHIC UNIT DESCRIPTIONS

Project	Site ID	Unit ID	Client	Sec	Page	1/4 of	1/4 of
	VEN-110	Trench 1	GREENWOOD #450C		2		1/4
Described by		Date					
		9 July 85					
Depth range	32	33	34	35	36	37	41
Horizon ID	10YR 4/2	10YR 4/2	10YR 6-7/3	10YR 4/2	10YR 6-7/3	10YR 6/4	10YR 4/3
Moist color	10YR 5/3	NR	NR	NR	NR	NR	NR
Dry color							
Mottles							
Moist color	NA	NA	NA	NA	NA	NA	NA
Dry color	NA	NA	NA	NA	NA	NA	NA
Abundance	NA	NA	NA	NA	NA	NA	NA
Size	NA	NA	NA	NA	NA	NA	NA
Texture	SL	L	SL	SL	SL	SL	SL
Sorting	MOD	MOD	MOD	MOD	MOD	MOD	MOD
% sand	60-70	40-50	60	60	60	40-50	40-50
Size range	CLAY-2F SAND	CLAY-2F SAND	CLAY-2F SAND	CLAY-2F SAND	CLAY-2F SAND	CLAY-2F SAND	CLAY-2F SAND
Mean size	F. SAND	C. SILT	F. SAND	F. SAND	F. SAND	C. SILT	F. SILT-CLAY
% > 2mm	φ	φ	φ	φ	φ	φ	φ
% > 4mm	φ	φ	φ	φ	φ	φ	φ
Grain roundness	SA-2SR	SA-2SR	SA-2SR	SA-2SR	SA-2SR	SA-2SR	SA-2SR
Grain spheric	SP-2S	SP-2S	SP-2S	SP-2S	SP-2S	SP-2S	SP-2S
Dark minis	<1	<1	<1	<1	<1	<1	<1
Bedding							
Thickness	NA	NA	THIN LAM	NA	THIN LAM	NA	NA
Continuity	NA	NA	CONTIN	NA	CONTIN	NA	NA
Convolution	NA	NA	PARALLEL	NA	PARALLEL	NA	NA
Consistence	MLO	MLO	MLO	MLO	MLO	MLO	MLO
Effervescence	NA	NA	NA	NA	NA	NA	NA
Cal(03) stage	NA	NA	NA	NA	NA	NA	NA
Boundary							
Waviness	W	W	W	W	W	W	W
Distinctness	C	A	A	A	A	VA	VA

(1) WEAK ORGANIC LAYER (2) W/UT THIN SILT AND CLAY LENSES (3) MICACEOUS FINE SANDS  
 (4) GRAVEL AND SHELL CONCENTRATED ALONG UPPER BOUNDARY  
 (5) EXCEPT ALONG LOWER CONTACT, <1% GRAVEL (MOST <2cm)

NR - NOT RECORDED NA - NOT AVAILABLE

## SIRATIGRAPHIC UNIT DESCRIPTIONS

[illegible]

(Comments)

- ① consists of 2 white clay lenses separated by sand lenses
- ② coarseness 36 but not apparent strat
- ③ w/ some 5 y 1/2 (moist) colors
- ④ midden;  $\pm$  HE LL

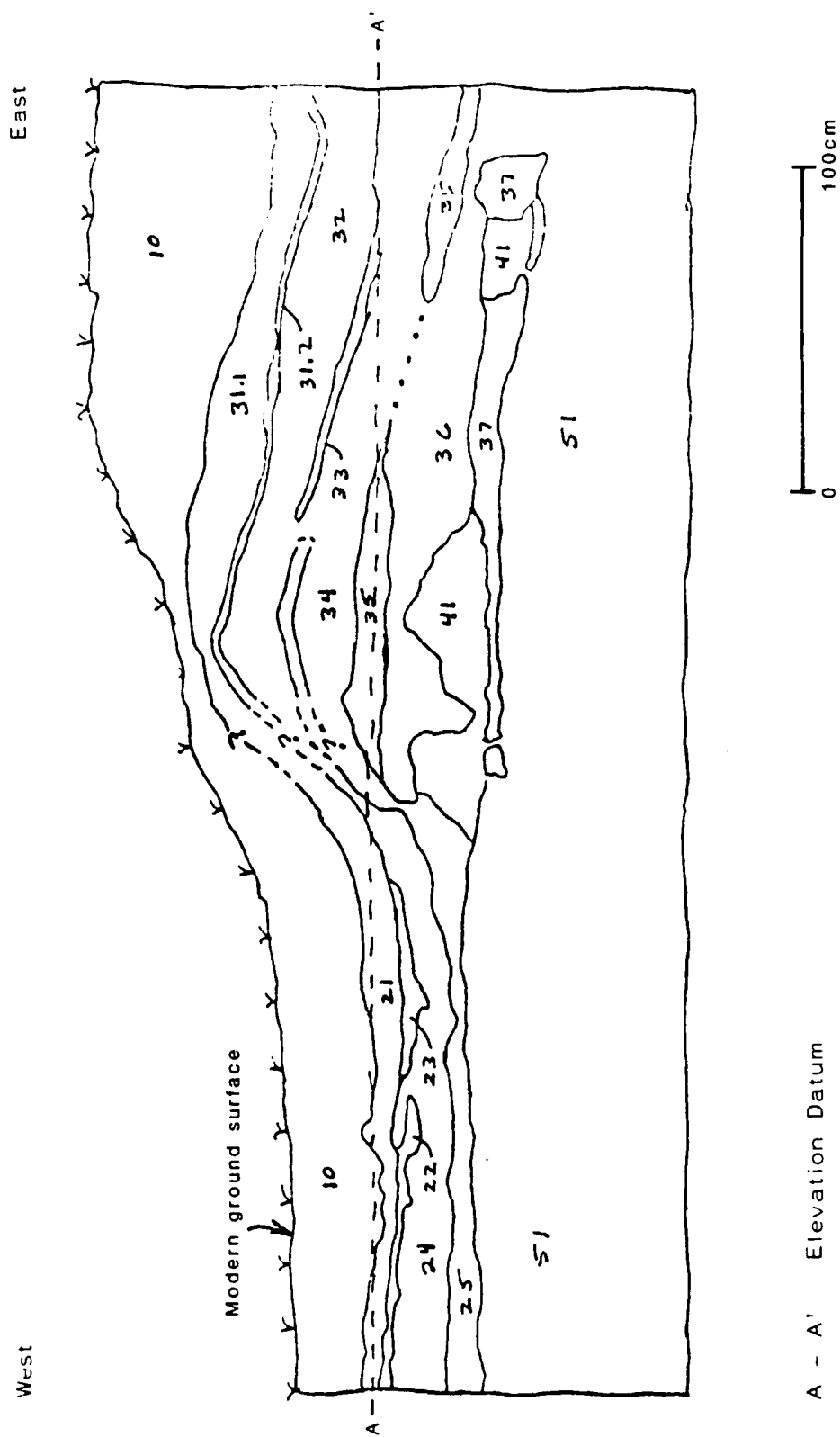


Figure A.1.1. Stratigraphic Cross Section of Trench 1

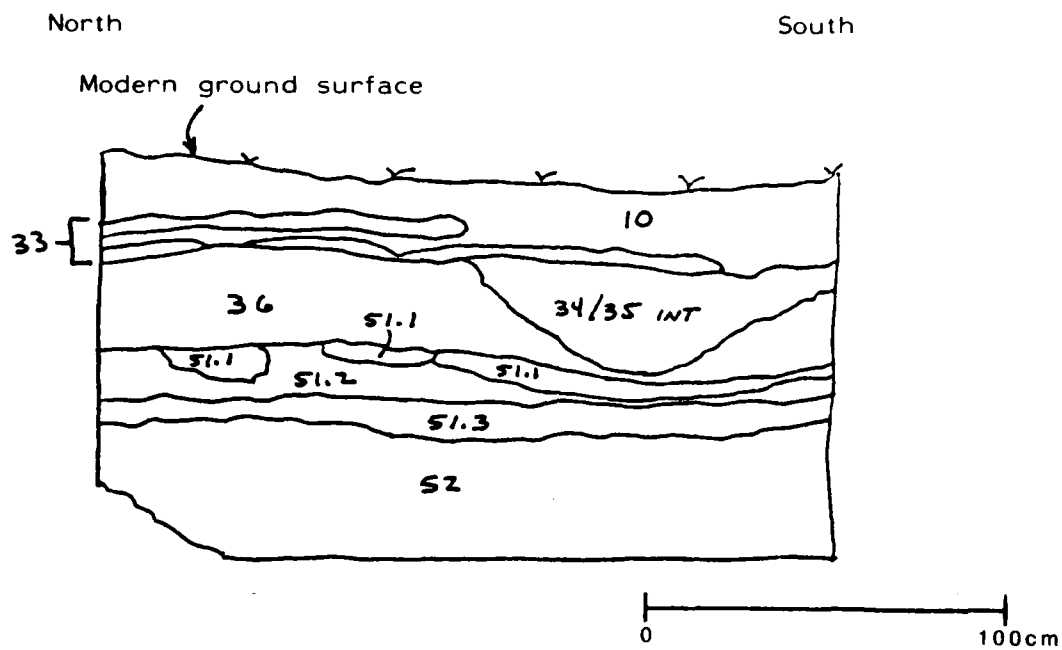


Figure A.1.2  
Stratigraphic Cross Section of Trench 6

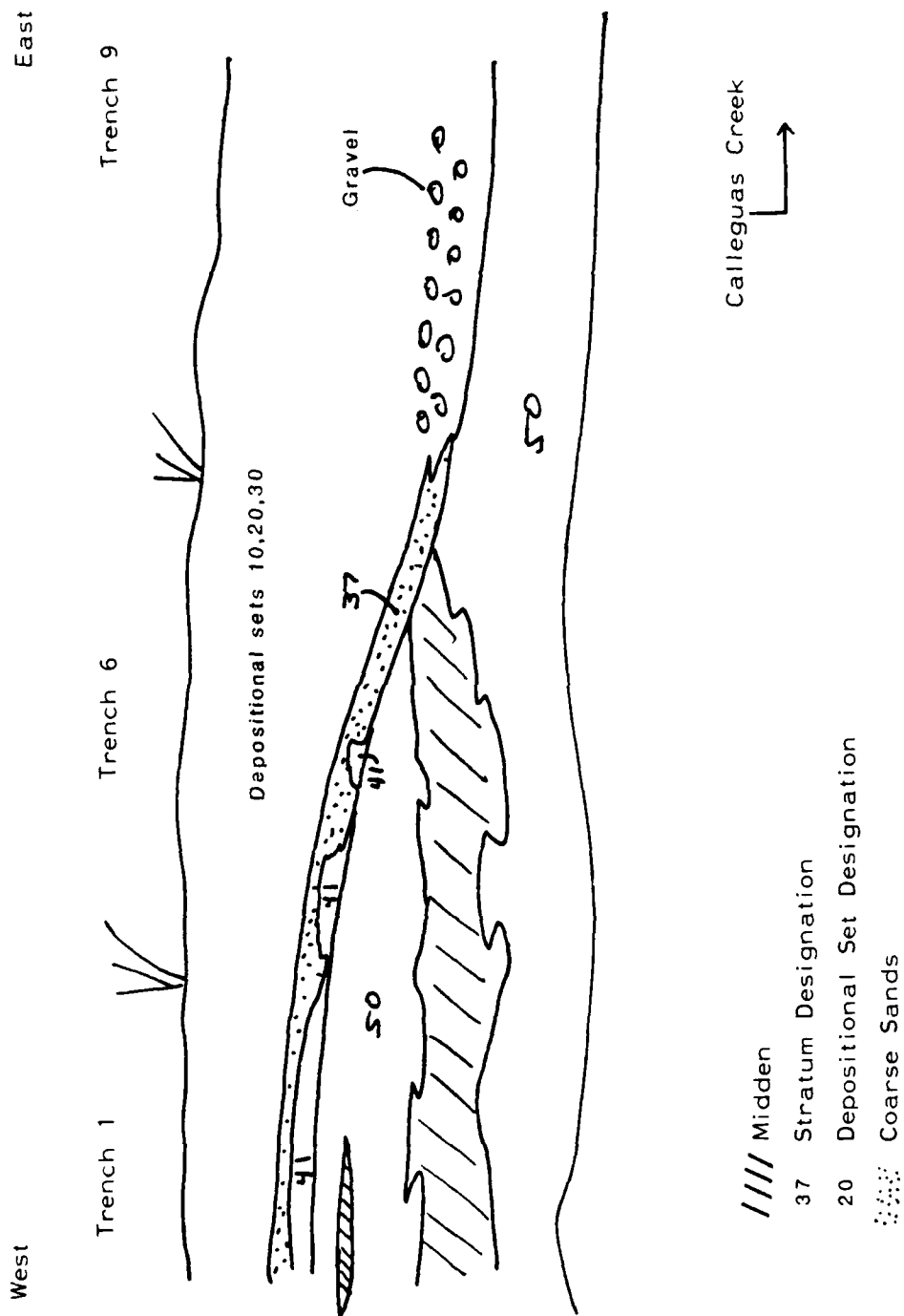


Figure A.1.3. Schematic Cross Section of CA-VEN-110



## APPENDIX 2

### ANALYSIS OF HUMAN SKELETAL MATERIAL FROM CA-VEN-110

by Christopher A. Webb and Patricia A. Owings Webb

#### Introduction

This report is an analysis of human skeletal remains encountered at CA-VEN-110 during an excavation conducted by Greenwood and Associates for the U.S. Army Corps of Engineers, Los Angeles District. A representative of the Candelaria American Indian Council and the Ventureño Chumash, Rita Valenzuela, was present during the excavation and laboratory analysis.

The material was recovered from Unit 3, a 1 x 1 m unit, and an easterly extension of 1 x 0.5 m, designated Unit 3 E. A double burial, adult female and subadult, was recovered from a depth below unit datum of 45 to 58 cm. All excavation was performed by C. Webb; photographs and drawings were made by R. S. Greenwood, J. M. Foster, G. Romani, and R. Valenzuela.

As a result of flood control activities in this century, the burials were at water level. This caused the osteological material to be especially fragile and created the need for special handling procedures in recovery. All bone was pedestaled as the surrounding soil was removed. As the exposure progressed, photographs and in situ observations were recorded. Typically, greater cleaning and more detailed measurement would have been done with the material still in place, but the delicate nature of the bone and rising water within the unit precluded this. Most of the bone was removed with much soil matrix adhering and packed carefully in boxes for transportation to the laboratory. When partially dried, the soil was removed and passed through 1/16 in screen. Several of the blocks of soil and bone were photographed

at successive stages of cleaning to record the relationship of underlying bone to the upper, exposed elements. After cleaning, all material was identified and analyzed metrically and non-metrically. All bone material was in a fair to poor state of preservation.

### Burial Descriptions

The burials occurred in a matrix of light brown silty clay loam. Above this level was an extremely dense shell midden with numerous pockets of fibrous plant material. Previous researchers had noted a similar type of organic matting (G. Romani, personal communication 1985), and C. Webb encountered it also when excavating Unit 2.

The burials represented an adult female and a subadult who were interred at the same time. Most of the subadult was present, but only the lower part of the adult, inferior to and including the second lumbar vertebra, was present. A mandibular fragment and a few cranial fragments from the adult were recovered, but none of the upper torso or arms. The cranial and mandibular fragments were scattered throughout the unit without correct anatomical context. The adult female was on the left side with legs flexed and knees pointing in a northwesterly direction. It was impossible to discern from the few vertebrae present whether the superior portion of the body was flexed.

The distal portions of the right tibia and fibula, the right tarsals and metatarsals, and all phalanges of both feet were missing from the adult female. The right innominate had turned approximately 90 degrees so that the posterior border was facing down, and the right tibia and fibula had both turned so that the posterior portions were also facing down. Both of these shifts could have occurred during or following decomposition of the soft tissue or during disturbance of nearby soil which did occur post mortem (J. Foster, personal communication 1985).

Along the medial posterior aspect of the right femur there is extensive evidence of gnawing by some type of rodent, and a rodent track was observed in this area. This might account for some of the missing posterior sections of the right leg, but there is no definite evidence of rodent activity on either the right tibia or right fibula.

Burning is evident on several of the bones (Table A.2.1), but it is superficial and has no apparent pattern.

The essentially correct anatomical relationships of the adult female bones, including such sensitive indicators as both patellae and several of the lumbar vertebrae, indicate that this is a primary interment. The interpretation is reinforced by the discovery of a shell bead adjacent to the fifth lumbar vertebra.

The subadult was interred face down with the head pointing in a northerly direction. The inferior portions of the body, from the innominates down, were displaced at least 20 cm from the lowest rib. There appears to have been some post mortem disturbance which could have been related, in part, to decomposition of the soft tissue, and possibly to the rodent activity that may have affected the adult.

Some degree of flexure in the subadult burial can be seen in the position of the left ilium, femur, unfused head and distal epiphysis of the left femur, and proximal portions of the left tibia and fibula. These bones were in correct anatomical relationship.

Missing from the subadult burial is most of the material from the upper extremities, all material inferior to the middle of both tibiae and fibulae, most of both scapulae, and most of the vault of the cranium. There is no apparent reason why these bones are missing. It is only speculation that a rodent is responsible.

Despite the displacement, most of the osteological material was oriented properly. Such elements as the rib cage, the anterior part of the cranium, and the left leg were correct and indicate that the subadult, like the adult female, was a primary burial. Their contemporaneous interment is shown by the close proximity and a certain degree of entwinement of the bones.

#### Adult Female

The adult burial is a female between the ages of 30 and 50 years. She was between 5' 3.4" and 5' 6.2" tall. She has possibly borne at least one child, although it is impossible to say whether the subadult with her is related. There were no apparent anomalies or pathologies on any of the bones. The determination of sex was made from measurements and observations of the following features:

1. Wide pubic portion of the right pubis - female (Bass 1971)
2. Ventral arch present on right pubic symphysis - female (Phenice 1967)
3. Narrow ridge on medial aspect of ischiopubic ramus of the right innominate - female (Phenice 1967)
4. Very wide greater sciatic notch on the right innominate - female (Bass 1971)
5. Deep pitted variety of pre-auricular sulcus present on right innominate - female (Houghton 1974)
6. Left femur head size of 42.1 mm - female (Dittrick 1979)
7. Left calcaneus and talus within size range of female (Steele 1976).

Determinations 2. and 3. above are derived from a set of three criteria developed by T. W. Phenice (1967). He has shown that with two or more of these criteria met, greater than 95% accuracy in sexing can be achieved. The third criterion, sub-pubic concavity, could not be evaluated from the material present.

In a study of prehistoric remains from central California, it was shown that 90% of the female sample from the Middle and Late Horizons had a maximum diameter of the head of the femur of less than 44.3 mm (Dittrick 1979).

Steele (1976) has shown that the talus and calcaneus may be measured and those measurements applied to several formulae that will allow the sexing of individuals with an accuracy of up to 89%. By this method also, the adult was female.

The age range of 30 to 50 years was determined by analysis of the pubic symphysis and vertebral bodies. The lower age limit was provided by the pubic symphysis which lacks ridges and grooves, has the ventral rampart filled in, and shows some disintegration of the symphyseal rim. These correspond to an age of 30+ years (J. Suchey, personal communication 1985). The lack of vertebral lipping on the lumbar vertebrae sets an approximate upper age limit of 50 years (McKern and Stewart 1957). No methods are available which will allow further narrowing of this range.

Stature reconstruction was based on a fragmented but complete fibula. The left fibula had good clean breaks, and all fragments were present so that an accurate measurement could be made. The formula for the fibula has the least variation of any long bone formula. The maximum length of the left femur is only approximate and therefore was not used as an indicator of stature. The left fibula is 35.8 cm long. Trotter and Gleser's white female formula (1952) was applied, giving the range of 5'

3.4" to 5' 6.2". It should be noted that racial differences may exist.

The pre-auricular sulcus present on the right innominate is the deep pitted variety. According to Houghton,

[this] is the result of the same series of physiological and pathological changes as occur at the pubic symphysis during pregnancy and labour. The pelvis must be of a female who has borne at least one child (1974:383).

A note of caution is added; there has not been extensive research on the pre-auricular sulcus, so the conclusion is regarded as only probable.

#### Subadult

The subadult is a more problematic individual for analysis. Many of the traits that have been studied for determining sex are not evident until after puberty when much of the sexual dimorphism of the human species becomes apparent on the osteological material. "The question still arises as to whether subadult skeletal material can be accurately sexed but the consensus is that any determination is little better than a guess" (Bass 1971:21).

It is possible to estimate age for the subadult from direct dental observations without the use of X-rays. Both the maxilla and mandible are present, and the deciduous teeth have erupted. The first permanent maxillary molar was in the process of calcification with most of the crown formed but not the root. This corresponds to an age of approximately 18 months to four years (Schour and Massler 1941).

Further analysis of the age may be achieved with measurement of the maximum length of the left femur with no epiphysis. This dimension is 171 mm, within the 2.0 to 2.5 year range in the standards developed by Maresh (1955). Johnston (1962), in another study of subadults, gives a slightly higher range of 2.5

to 3.5 years. Based on both dental and osseous data, it may be stated that the subadult is from 2.0 to 3.5 years of age.

No pathologies were noted, but an interesting anomaly is present. While all deciduous dentition is present in the maxilla, the mandible has only two deciduous incisors. There is no evidence of any tooth loss, so it appears that the subadult actually lacked two incisors congenitally. Brothwell noted that the "Absence of incisors has been found to be much more common in Mongoliform groups including Eskimos (Pederson 1949) than among Europeans" (1972:116). It may be informative to X-ray the mandible to determine what type of tooth formation is present below the surface of the bone.

#### Discussion

It is not recommended that analysis for transverse lines be attempted because, "The precise etiologies for their appearance are varied and controversial, and lines are also known to resorb during both childhood and the adult years" (Hummert and Van Gerven 1985:297).

We need much more information about the factors which may cause transverse lines to appear in the absence of illness and the factors which may prevent the appearance of lines after illness (Marshall 1967:259).

At Simo'mo, a nearby cemetery which has been dated from A.D. 300 to A.D. 1300, Martz (1984) noted that 40% of the burials were face down. It is important to determine a date for the burials from this site to see if Martz' data are applicable in this instance. Martz also reported that 22% of the burials at Simo'mo were buried with at least one other individual. A careful comparison of the current burials with the data presented by Martz is strongly suggested.

Rita Valenzuela, the Native American representative, was present during the human osteological analysis. When she learned that the subadult was buried face down, Mrs. Valenzuela related that her relatives had spoken of burial in this position as being a form of punishment. As cited above, Martz (1984) reported that 40% of the burials at Simo'mo, a nearby cemetery, were interred face down. The frequency of this position at Simo'mo raises the question whether punishment is the only explanation for the face down burial posture.

We wish to express our thanks to Dr. J. M. Suchey for her review of the osteological material and her critical reading of this report.

Table A.2.1

Osteological Inventory: Adult

All material is partial and incomplete unless otherwise noted.

Cranial vault - several fragments with non-closed sutures

Upper 1/3 of left ramus of mandible - including condyle and coronoid process

Lumbar vertebrae 2, 3, 4, 5 - complete but fragmented

Right innominate - complete but fragmented

Left innominate

Right femur - complete but fragmented, partially burned

Left femur

Right patella - complete, partially burned

Left patella - complete, partially burned

Right tibia - proximal 3/4, partially burned

Left tibia - complete but fragmented

Right fibula - proximal 3/4

Left fibula - complete but fragmented

Left calcaneus



Left talus - complete  
Left navicular  
Left cuboid - complete  
Proximal portion of 1st to 4th metatarsals  
2 small rib fragments

Table A.2.2

Osteological Inventory: Subadult

All material is partial and incomplete unless otherwise noted.

Mandible - complete but fragmented  
Maxilla - complete but fragmented  
Right temporal  
Cranium - various small fragments that were immediately posterior  
to maxilla  
Cranial vault - one small piece, burned  
Vertebral fragments - various, including pieces of both atlas and  
axis  
Right clavicle - complete  
Left clavicle - medial 1/4  
Right first rib - complete  
Left first rib - complete  
Other ribs - numerous fragments  
Spine of left scapula  
Right humerus - proximal 1/4  
Head (epiphysis) of humerus  
Right ilium  
Right ischium  
Right pubis - complete  
Left ilium  
Right femur  
Left femur - broken but complete  
Heads (epiphyses) of both femora

Right tibia - proximal 1/3

Left tibia - proximal 1/2

Right fibula

Left fibula - proximal 1/3

Numerous other fragments, including some epiphyses, too small to be identified; some burned

Table A.2.3

Anthropomorphic Measurements

Adult

Left fibula: Maximum length - 358 mm

Left femur: Maximum length - 428 mm (estimated)

Anterior-posterior diameter of mid-shaft - 25 mm

Medio-lateral diameter of mid-shaft - 25 mm

Maximum head diameter - 42 mm

Circumference of mid-shaft - 79 mm

Subtrochanteric anterior-posterior diameter - 21 mm

Subtrochanteric medio-lateral diameter - 34 mm

Right femur: Maximum length - 425 mm (field measurement)

Left tibia: Maximum length - not possible

Anterior-posterior diameter at nutrient foramen -  
30 mm

Medio-lateral diameter at nutrient foramen - 20 mm

Left calcaneus: Body height - 38 mm

Load arm width - 39 mm

Left talus: Maximum length - 48 mm

Maximum width - 40 mm

Subadult

Right femur: Maximum length - 171 mm

Left femur: Maximum length - 169 mm (estimated)

Dental formula:        2        1        2  
                         i   -   c   -   m   -   .   Note variation of incisors.  
                         1        1        2

Table A.2.4

Additional Material from Other Provenience

Unit	Level	Identification
1	80-90	Possible human deciduous molar
2	60-70	Probable human deciduous canine
2	70-80	Probable human incisor; small trace of shoveling
2	80-90	Human incisor; adult
3	7	Possible human cranial fragment
3	8B	Possible human cranial fragment
3	9B	Probable human deciduous molar; small trace of shoveling
3	10B	Probable human cranial fragment with portion of open suture
6	4	Possible human molar or pre-molar

### References Cited

Bass, W. M.

- 1971 Human Osteology: A Laboratory and Field Manual of the Human Skeleton. Missouri Archaeological Society, Columbia.

Brothwell, D. R.

- 1972 Digging up Bones. British Museum, London.

Dittrick, J.

- 1979 Discriminate Function Sexing by Femur and Humerus in Central California Prehistoric Samples. Unpublished Master's thesis, Department of Anthropology, California State University, Fullerton.

Houghton, P.

- 1974 The Relationship of the Pre-auricular Groove of the Ileum to Pregnancy. American Journal of Physical Anthropology 41:381-389.

Hummert, J. R., and D. P. Van Gerven

- 1985 Observations on the Formation and Persistence of Radiopaque Transverse Lines. American Journal of Physical Anthropology 66:297-306.

Johnston, F. E.

- 1962 Growth of the Long Bones of Infants and Young Children at Indian Knoll. American Journal of Physical Anthropology 20:725-742.

Maresh, M. M.

- 1955 Linear Growth of Long Bones of Extremities from Infancy Through Adolescence. American Journal of Diseases of Children 89:725-742.

Marshall, W. A.

- 1967 Problems of Relating the Presence of Transverse Lines in the Radius to the Occurrence of Disease. In The Skeletal Biology of Earlier Human Populations, edited by D.R. Brothwell, pp. 245-261. Pergamon, New York.

Martz, P. C.

- 1984 Social Dimensions of Chumash Mortuary Populations in the Santa Monica Mountains Region. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Riverside. University Microfilms International, Ann Arbor.

McKern, T. W., and T. D. Stewart

- 1957 Skeletal Age Changes in Young American Males, Analyzed from the Standpoint of Identification. Headquarters Quartermaster Research and Development Command, Technical Report EP-45. Natick, Massachusetts.

Phenice, T. W.

- 1967 A Newly Developed Visual Method of Sexing the Os pubis. American Journal of Physical Anthropology 30:297-302.

Schour, I., and M. Massler

- 1941 The Development of the Human Dentition. Journal of the American Dental Association 28:1153-1160.

Steele, D. G.

- 1976 The Estimation of Sex on the Basis of the Talus and Calcaneus. American Journal of Physical Anthropology 45:581-588.

Trotter, M., and G. C. Gleser

- 1952 Estimation of Stature from Long Bones of American Whites and Negroes. American Journal of Physical Anthropology 10:463-514.

### APPENDIX 3

#### PRELIMINARY OVERVIEW AND SEASONALITY ANALYSIS OF THE FISH REMAINS FROM CA-VEN-110

by Richard W. Huddleston  
Scientific Research Systems

##### Introduction

Within the last two decades the overall extent of information contributed by the identification and evaluation of fish remains from archaeological excavations has increased exponentially. Fish analysis no longer consists of a mere list of scientific names in the back pages of a report or a passing reference such as, "The remains of fish were numerous." Now when a species is identified, the habitat and range of the species are examined for insight into the ecological regions that were being exploited by the inhabitants of the site. Additionally, this information leads to recognition and/or speculation about the technological level of achievement of the inhabitants, as well as the methodology developed to assure capture of certain fish species. In many cases, the highly significant question of seasonality of site occupation can be determined objectively, rather than by the "best guess" approach.

The significance of data derived from fish remains in the broad conceptual reconstruction of an extinct community is being more fully recognized. The early coastal inhabitants of southern California were not purely sports fishermen. The fishes that they pursued and caught played a vital role and major component of their subsistence. Hence, they did not fish in a haphazard manner. Their skills were highly perfected through many generations of experience stimulated by pure necessity. The waters off southern California provided a rich hunting ground for these people, enticing them to become true hunters of the sea.

The immediate objective of this study was to evaluate the research potential of the fish remains from cursory inspection of the collection. The aims were to extract as much information as possible within a limited time, document and report those species most obviously present, and assess the significance of their presence within the site. This preliminary overview included the identification and seasonality analysis of 33 otoliths.

The seasonality section is presented separately. The taxa identified in that study along with the taxa recognized and documented during the cursory inspection of the large quantity of fish bone are briefly discussed. It should be emphasized that the undertaking of a preliminary examination of the additional bony material was primarily to scan and recognize additional species present which were not represented among the otolith material. Therefore, such taxa are simply presented without reference to provenience data, quantitative analysis, or other analysis, and the species array is not represented as complete. A more detailed study was beyond the scope of the immediate objectives. Such analysis can be deferred; the results to date clearly indicate that the material warrants more analytical attention.

#### Seasonality Analysis

It was possible to attribute seasonality to 32 of the 33 otoliths examined. A variety of techniques was employed, which will be discussed in a forthcoming publication. For reasons not yet understood, the incremental seasonal growth rings within the otoliths of this collection were generally obscured, and it was exceptionally difficult to make the seasonality determinations. For additional discussion of otolith rings, see Huddleston 1981.

It appears from the seasonality data (Table A.3.1) that fishing occurred year around. There are more late summer readings than from any other seasonal subdivision, however, suggesting that while the activity was conducted all year, there was more

emphasis on fishing during the late summer period.

Table A.3.1  
Otoliths from CA-VEN-110

Scientific Name	Provenience	Seasonality
1. <u>Genyonemus lineatus</u>	Unit 1, 90-100	Mid winter
2. <u>Paralichthys californicus</u>	Unit 1, 110-140	Mid summer
3. <u>Sebastes alutus</u>	Unit 1, 110-140	Late summer
4. <u>Genyonemus lineatus</u>	Unit 2, 70-80	Late summer
5. <u>Paralichthys californicus</u>	Unit 3, level 2	Mid summer
6. <u>Sebastes</u> sp.	Unit 3, level 2	Mid summer
7. <u>Roncador stearnsi</u>	Unit 3, level 3	Late summer
8. <u>Umbrina roncador</u>	Unit 3, level 3	Late summer
9. <u>Sphyræna argentea</u>	Unit 3, level 4	Late winter
10. <u>Paralichthys californicus</u>	Unit 3, level 4	Late winter
11. <u>Sebastes</u> sp.	Unit 3, level 4	No reading
12. <u>Rhacochilus vacca</u>	Unit 3, level 4	Early summer
13. <u>Sebastes goodei</u>	Unit 3, level 4	Early summer
14. <u>Sebastes</u> sp.	Unit 3, level 5	Early summer
15. <u>Sebastes paucispinis</u>	Unit 3, level 6	Late winter/ early summer
16. <u>Sebastes goodei</u>	Unit 3, level 6	Late winter/ early summer
17. <u>Sebastes goodei</u>	Unit 3, level 9B	Late summer/ early winter
18. <u>Embiotoca jacksoni</u>	Unit 3, level 9B	Mid summer
19. <u>Sebastes</u> sp.	Unit 3, level 11B	Late winter/ early summer
20. <u>Sebastes</u> sp.	Unit 3E, level 3A	Early winter
21. <u>Menticirrhus undulatus</u>	Unit 3E, level 3B	Early summer
22. <u>Sebastes goodei</u>	Unit 3E, level 3B	Late summer/ early winter
23. <u>Genyonemus lineatus</u>	Unit 4, level 8	Late summer
24. <u>Sebastes</u> sp.	Unit 5, level 2	Late winter
25. <u>Atractoscion nobilis</u>	Unit 5, level 3	Late summer



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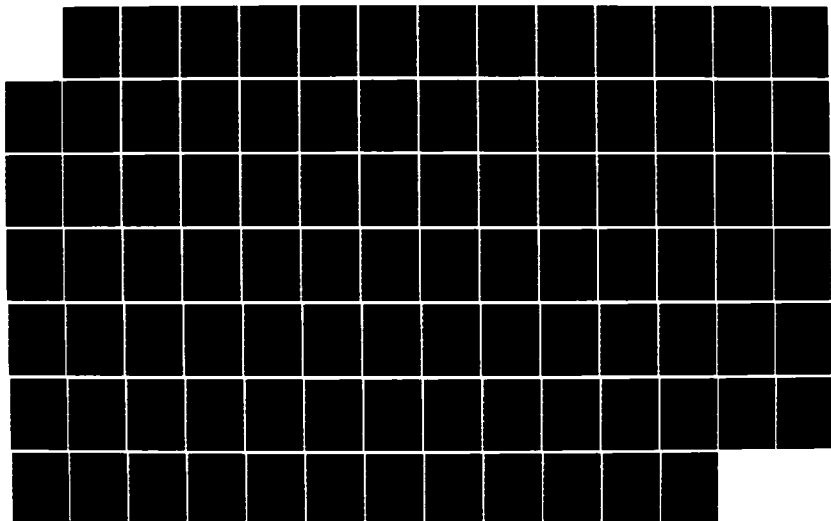
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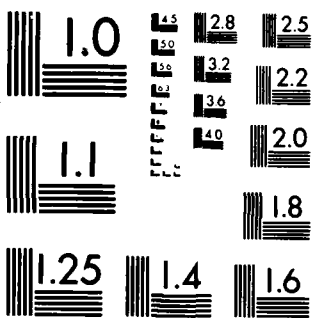
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MICROCOPY RESOLUTION TEST CHART  
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26. <u>Sebastes goodei</u>	Unit 5, level 3	Late summer
27. <u>Paralichthys californicus</u>	Unit 5, level 3	Late summer
28. <u>Sebastes goodei</u>	Unit 5, level 3	Late summer/ early winter
29. <u>Sebastes goodei</u>	Unit 5, level 3	Late summer
30. <u>Sebastes miniatus</u>	Unit 6, level 3	Late summer/ early winter
31. <u>Sebastes</u> sp.	Unit 6, level 3	Early/mid winter
32. <u>Sebastes</u> sp.	Unit 6, level 3	Late winter
33. <u>Sebastes</u> sp.	Unit 6, level 3	Late summer/ early winter

#### Taxa Identified in Preliminary Examination

Table A.3.2 lists the families and species which have been identified to date from the otolith examination and a preliminary scanning of the great bulk of fish remains.

Table A.3.2

#### Taxonomic Listing of Fish Identified from CA-VEN-110

##### Sharks and Rays

###### Family Myliobatidae

Myliobatis californica bat ray

###### Family Rhinobatidae

Rhinobatus productus guitarfish

###### Family Carcharhinidae

Prionace glauca blue shark

###### Family Squatinidae

Squatina californica angel shark

###### Family Triakidae

Unidentified smoothhound sharks

###### Family Heterodontidae\*

Heterodontus francisci horn shark

\* Identified from dorsal spine (A. Tejada-Flores)

## Bony Fishes

### Family Bothidae

#### Paralichthys californicus

Pacific halibut

### Family Sciaenidae

#### Atractoscion nobilis

white seabass

#### Roncador stearnsi

spotfin croaker

#### Umbrina roncador

yellowfin croaker

#### Genvonemus lineatus

white croaker

#### Menticirrhus undulatus

California corbina

### Family Sphyraenidae

#### Sphyraena argentea

Pacific barracuda

### Family Scorpaenidae

#### Sebastes goodei

chilipepper

#### Sebastes miniatus

vermilion rockfish

#### Sebastes alutus

Pacific ocean perch

#### Sebastes paucispinis

bocaccio

#### Sebastes sp.

unident. rockfish

### Family Embiotocidae

#### Embiotoca jacksoni

black surfperch

#### Rhacochilus vacca

pile surfperch

### Family Clupeidae

#### Sardinops sagax

Pacific sardine

### Family Scombridae

#### Sarda chiliensis

Pacific bonito

#### Scombrid - unidentified

### Family Percichthyidae

#### Stereolepsis gigas

giant seabass

## Summary

Preliminary analysis of the fish material from CA-VEN-110 indicates that the inhabitants of this site possessed an excellent knowledge of fishing techniques. The types of fishes so far identified reveal that the inhabitants were fishing the inshore surfzone regions as well as the kelp bed and offshore areas. They probably utilized spear, nets, harpoon, and hook and line fishing techniques. There is evidence that they fished year

around, with perhaps greater activity in the late summer months. These data are only preliminary, and it is not possible at this stage to offer speculation as to which environmental region was most significant for their subsistence needs. More detailed study and quantitative analysis would contribute greatly to this question.

The pure abundance of the fish remains and the diversity of species they represent reflect that maritime exploitation played an important role as a major subsistence source to the inhabitants of CA-VEN-110. The array of species already identified and the presence of particular types of species lend insight into not only the technological level or proficiency of the inhabitants, but also the geophysical and environmental parameters or extent of such parameters that were actively utilized.

The level of technological skill as well as the environments exploited need to be more fully studied. The value of such data that can be extrapolated from additional research is deeply inter-connected directly and indirectly to other facets of cultural activities and community structure. Such studies may contribute greatly to the illumination of other aspects of the socio-economic structure of the inhabitants of CA-VEN-110.

In recent years fish analysis has been recognized to form an integral part of the overall cultural evaluation of an archaeological study. To extract the greatest amount of information possible from the wealth of fish remains at CA-VEN-110, I propose the following recommendations:

1. Sufficient funding should be provided for the identification and analysis of all fish bone and teeth. This requires detailed examination and quantification, and can be time consuming.

2. Screens of at least 1/16 inch mesh should be employed during excavation, and the residue should be sorted under an adequate magnifying lens or low power binocular microscope, by an individual familiar with micro-bone remains, particularly fish otoliths.

3. At least one, preferably more, unprocessed column sample should be collected and saved for micro-analysis for fish remains. These column samples should be independent of any others that might be taken for various other studies such as pollen spores, soil chemistry, etc.

4. The processing of column samples should be conducted by individuals familiar with recovering fish remains, and the entire sample should be screened down to 30-mesh. Such a study eliminates any collecting bias unavoidable when finer mesh screens are not employed. The significance of using such fine mesh screens is discussed in Huddleston and Barker (1978).

#### References Cited

Huddleston, R. W.

- 1981 Fish Remains from an Archaeological Site (Ora-193) at Newport Bay, Orange County, California. Pacific Coast Archaeological Society Quarterly 17(2-3):127-139.

Huddleston, R. W., and L. W. Barker

- 1978 Otoliths and Other Fish Remains from the Chumash Midden at Rincon Point (SBa-1), Santa Barbara-Ventura Counties, California. Natural History Museum of Los Angeles County Contributions in Science No. 289.

## APPENDIX 4

### BEADS FROM VEN-110

By Chester King

#### Introduction

The beads recovered from test excavations at VEN-110 have been catalogued by type and their maximum diameters have been measured. The size of the perforation of all holes larger than 1.8 mm was also measured. This report discusses the beads which were found at VEN-110 in terms of the time periods they were used. This study is based on a cursory analysis of the beads and ornaments which have been found. In the Chumash area, finished beads are frequently found in or near houses or shelters, in cemeteries, and at shrines. They are not known to occur in other contexts. It appears that most of the excavation units at VEN-110 were in residential areas of the site. The bead types recovered from VEN-110 have previously been described in King 1982a, b, and Gibson 1976.

#### Periods of Occupation at VEN-110

The beads and ornaments from VEN-110 indicate that the site was occupied from Middle Period Phase 3 (ca. AD 300-700) until at least AD 1809 when Indians were last recruited from Mugu to Ventura mission. No beads such as dorsal ground saucers or chlorite schist disc beads were found which would indicate pre-Middle Period Phase 3 occupations.

#### Middle Period Phase 3 (ca. AD 300-700)

Half of a Megathura crenulata ornament was recovered from Unit 2, 90-100 cm. The ornament consists of only the callus area and the surface of the callus has been ground smooth. This type of Megathura ornament was last used during Phase M3. A number of Olivella saucer beads which are characterized by perforations of approximately 2.0 mm diameter were recovered from Units 1, 2, 3,

and 4. This was the most common type of bead used during Phase M3. They were also used during Phase M5a and some of the saucer beads at VEN-110 were probably made at this time.

#### Middle Period Phase 4 (ca. AD 700-900)

The most common type of bead used during Phase M4 was a type of Olivella wall disc bead. I have not seen any artifacts from the site which were only used during Phase M4. Two split-drilled Olivella beads were recovered. One was found in Unit 3 and the other Unit 5. These beads may have been used during Phase M4 but may also have been used during Phase M5 a and b.

#### Middle Period Phase 5a and b (ca. AD 900-1050)

In addition to the split-drilled beads just mentioned and the saucer beads discussed for Phase M3, large beads made from Mytilus californianus were recovered. These beads with diameters of over 8.0 mm were only made during Phase M5a. They were found in Units 1, 3, 4, 5, and 6.

#### Middle Period Phase 5c (ca. 1050-1150)

A split-punched bead was recovered from Unit 6, level 5. In the Chumash area this bead type was used only during Phase M5c. Several other beads also indicate occupation during Phase M5c. These include small spire and base ground Olivella shells, segments of Dentalium neohexagonum shells, and small Olivella wall disc and mussel disc beads. These types continued to be used into the early Late Period.

#### Late Period Phase 1 (ca. AD 1150-1500)

Most of the Olivella cupped beads in the VEN-110 collection were probably made during Phase L1. Later Phase 2 cupped beads are often ground on their dorsal surface and are seldom over 4.5 mm in diameter. The range of sizes and lack of dorsal grinding on cupped beads indicate that most cupped beads in the collection were made during Phase L1. The presence of relatively small Olivella spire and base ground beads which appear similar to



cupped beads also indicate Phase 1 occupation.

Late Period Phase 2a (ca. AD 1500-1650)

Five Olivella thin-lipped beads were recovered from the test excavations. These were only made during Phase L2a. Two were in Unit 3, one in Unit 4, and two in Unit 5. One Olivella cylinder bead was recovered from Unit 2; this bead may have been used during Phase L2a or L2b.

Late Period Phase 2b (ca. AD 1650-1782)

During an earlier surface collection and auger testing program at VEN-110, an Olivella full-lipped bead was recovered (VS-80-08). This indicates occupation during Phase L2a.

Late Period Phase 3 (ca. AD 1782-1830)

Occupation during the early Spanish mission period is indicated by the presence of glass beads, Olivella rough disc beads, and Haliotis rufescens epidermis disc beads with small perforations and relatively large diameters. These types of historic beads were recovered from the 0-10 cm level of Unit 2, and Units 3, 5, and 6. In Unit 3, historic period bead types were found in all levels and it appears that the deposit was mixed by excavation during the last occupation at the site or later. The Olivella rough disc beads from Unit 2 and some from Unit 3 are over 6.0 mm in diameter and were probably made after AD 1810. These may indicate that the site was occupied after everyone had been baptised.

Conclusion

It appears that VEN-110 was first occupied sometime between AD 300 and 700. After this time it appears that the site was continually occupied until its inhabitants moved to Ventura Mission. This is indicated both by the presence of beads diagnostic of many time periods and by the frequencies of beads of types less diagnostic of particular time periods.

Possibility of Unit 3 Being in the Area  
of a High Status Household

Unit 3 has a higher ratio of Olivella wall beads compared to cupped beads than other units. It contained six of the nine Haliotis rufescens disc beads recovered. Over half of the collection of beads recovered from VEN-110 was also from Unit 3. All of these measures indicate that Unit 3 was in the area of a relatively high status household.

Bias in Bead Recovery

The use of 1/8 inch mesh screens for recovery of artifactual remains from archaeological sites does not assure the recovery of the full range of beads present in a site. When 1/8 inch mesh screens are used beads with diameters less than 3.5 are usually discarded in screen tailings (King 1982b:2). During some time periods such as the terminal Middle Period and the beginning of the Late Period (Phases M5c and L1a ca. AD 1050-1250), most beads used in the Santa Barbara Channel region were less than 3.5 mm in diameter. The presence of bead types diagnostic of the Middle-Late Period transition and the relatively high frequency of small mussel and Olivella wall disc beads at VEN-110 indicate that many small beads were discarded during screening. Probably between 1/3 to 1/2 of the beads present in the units excavated were discarded in the field. The actual frequencies of small beads can only be determined when complete samples of beads are saved. Knowledge of the composition of the sample of all beads retained in screens with meshes of 1/16" or smaller is necessary to determine the actual frequencies of all bead sizes present in an excavation unit. The determination of the social statuses of different households and the relative numbers of beads deposited at different time periods can be most easily accomplished when the actual frequencies of all beads in the excavated samples is known.

### References Cited

Gibson, Robert O.

- 1976 A Study of Beads and Ornaments from the San Buenaventura Mission Site (Ven-87). In The Changing Faces of Main Street, edited by Roberta S. Greenwood, pp. 77-166. Redevelopment Agency, City of San Buenaventura.

King, Chester DeWitt

- 1982a The Evolution of Chumash Society: A Comparative Study of Artifacts Used in Social System Maintenance in the Santa Barbara Channel Region Before A.D. 1804. Pd.D. dissertation, University of California, Davis. University Microfilms.
- 1982b Beads, Ornaments, and Other Artifacts Used to Maintain Social Relationships. In Archaeological Investigations at Talepop (LAN-229) (Draft Report), by Chester King et al., vol. II, 6:1-78. Ms. submitted to the California Department of Parks and Recreation. Office of Public Archaeology, University of California, Santa Barbara.

## APPENDIX 5

### POLLEN STUDIES AT THE CALLEGUAS CREEK SITE (CA-VEN-110): RESEARCH PROSPECTS

by James Schoenwetter  
Arizona State University

#### Introduction

Eight sediment samples from the Calleguas Creek site (CA-VEN-110) were submitted to the Palynological Laboratory of the Department of Anthropology at Arizona State University in August 1985. The samples were collected as part of an archaeological effort designed to determine if the site retains research potential. The primary questions palynological data recovered from the samples were asked to address were: (1) what is suggested about site integrity, (2) what is suggested about site chronology, (3) what is suggested about site environment, and (4) what is the potential of pollen analysis to assist functional interpretations of ground stone tools.

Because the last of these problems is a matter of some research significance, items recovered from the site which were potentially classifiable as ground stone tools were given special field treatment to avoid pollen contamination. Special handling continued in the laboratory, where the sediment was scraped from these items under pollen-sterile conditions and the scrapings isolated. This activity documented that none of the items was, in actuality, a ground stone tool. The pollen samples the items yielded, however, may be considered generally informative about pollen samples that would be collected from ground stone tools if subsequent excavation of the site is undertaken. Half of the eight sediment samples submitted for analysis were of sediment that had been scraped from rock in this fashion. The other four

were samples collected from the sediments sectioned by the test excavations at particular levels of excavation Units 2 and 4. The former samples were substantially smaller - about one-third the roughly 50-75 cc volume of the latter (excluding volume of shell fragments).

All of each sample submitted for pollen study was processed to remove and concentrate the pollen it contained. The extraction procedure was almost identical for all samples. The bulk of large bivalve shell fragments was removed from the larger samples prior to processing, however, and those samples were then crushed to speed chemical digestion of retained calcium carbonate by hydrochloric acid. The pollen extraction procedure used (Schoenwetter 1979) is based upon the same principles as the one employed by Hevly on coastal plain deposits in San Diego County (Hevly and Diggs n.d.). Quite different principles of pollen extraction were employed by Woosley (1978) on the only other example of Ventura County pollen analysis known to me.

The extraction procedure concentrates that smaller volume of original sample which contains material that is as small or smaller than pollen grains, has a similar specific gravity, and has a similar chemistry. Generally speaking, the concentrate is the fraction of plant cellular material in the original sample - of which a fraction is pollen. The amount of extract, then, depends more upon the nature of the original sample than upon its volume, although one generally expects a larger volume sample will yield a larger volume extract.

The non-representative character of the submitted samples makes normal palynological analysis fruitless. Vegetation or ecosystem reconstructions developed on the basis of eight samples alone would be too poorly evidenced to be credible even if all were easily analyzed and large numbers of pollen grains were observed for each sample. Similar objections would apply to attempts to establish a method for the construction of a pollen chronology,

or to attempts to interpret the behavioral significance of so small a set of pollen records. It was not efficient, then, to invest more time in the formal pollen analysis - that is, identification and counting of pollen types - than was required to establish the potential for future pollen studies to resolve the questions posed above.

## Results and Discussion

### Large Sample/Small Sample Comparisons

None of the samples collected from column proveniences (large volume samples) yielded greater amounts of extract than one of the samples of sediment scraped from stones (small volume samples). However, three of the extracts from the four small volume samples were 1/2 to 1/3 the volume of the smallest extract from any of the large volume samples.

Extract volume seems to have no necessary correspondence to pollen density, however (Table A.5.1). The extract with greatest volume, which derives from one of the small volume samples, contains an estimated 70 pollen grains per 0.05 cc. The extract with least volume, which also derives from one of the small volume samples, contains an estimated 20 pollen grains per 0.05 cc. Both lower (10 pollen grains per 0.05 cc) and higher (>10,000 pollen grains per 0.05 cc) pollen densities occur in samples which yielded volumes of extract between the high and low extremes of volume. Pollen density also has no necessary correspondence to sample provenience. One of the small volume (stone item scrapings) samples yields less pollen (10 grains per 0.05 cc) than any of the large volume (column) samples. But two yield the same amounts as two of the column samples (20 grains/0.05 cc and 70 grains/0.05 cc), and one yields more than two of the column samples yield (2,500 grains/0.05 cc).

The original volume of the sample thus seems irrelevant to the question of whether a research investment is likely to result in

Table A.5.1

Pollen records of the Calleguas Creek site (CA-VEN-110). Ostensibly younger records are arrayed above ostensibly older ones.

SAMPLE				POLLEN OBSERVED										
Unit	Level	Lrg. Sm. Vol. Vol.	Pollen grains per .05 cc extr-c act	Deposi- tional envir.	Cheno- am	Tubu- li- florae	Gra- min- eae	Quer- cus	Pinus	Cupress- acae	Typha tetr- ads	Plan- tago	Un- kno	
3	8	x	20	Trash Pit Fill										
2	10- 22 cm	x	>10,000	midden	81	4	6	1	1	1	2		6	
1	50- 60 cm	x	2,500	clay	93	7	2	2	1		2			
3	4	x	10	rodent disturbed midden										
4	4	x	20	midden										
4	10	x	70	midden										
6	5	x	70	midden										
2	105- 110 cm	x	>10,000	midden	78	4	2	4	2		1			

an analyzable pollen count. Small volume scrapings samples from stone items resulted in adequate pollen yields for analysis in two cases out of four. Large volume column samples resulted in adequate pollen yields for analysis in three cases out of four.

#### Provenience/Content Comparisons

The three pollen samples with highest yields were given the cursory analysis afforded by 100-grain observations. The two samples from Unit 2, collected at 10-22 cm and 105-110 cm levels, are from the uppermost midden stratum and the basal midden stratum exposed at this unit. There is no statistically significant difference in the pollen content of these two samples. The sample from Unit 1, collected at the 50-60 cm level, is not significantly different in pollen content from the other two although it derives from a clay (not midden) context. Palynological differences which are not statistically significant, however, segregate the non-midden record from the two pollen records of midden deposits. The importance of such distinctions could be amplified by arithmetic manipulation of the pollen sum, which could easily be justified on the basis of the evidence for local overrepresentation of Cheno-am pollen in these samples.

The identification of pollen zones, which is a preliminary step in the existing methods for establishment of a pollen chronology, is normally based on statistically significant distinctions amongst the pollen spectra of samples. The reason this is standard practice, however, is that the existing methods assume that the separate events represented in a pollen chronology are events of ecosystemic change induced by factors other than human behavior. The suggestion from these palynological records is that this sort of ecosystemic change did not occur through the period represented by the deposition of any of the pollen samples at CA-VEN-110. But sequentially organized pollen record changes which are not statistically significant occur that seem to relate to the midden/non-midden provenience contrast. The most



parsimonious explanation is that they are due to behavior patterns, which may have changed through time. This suggests that potential exists for the application of pollen analysis to problems of intra-site stratigraphy even though pollen zonation (thus, pollen chronology construction) seems unlikely. Such an application would require establishing evidence that midden deposits laid down at different times contained distinctive palynological "signatures" representing different kinds of cultural ecological relationships.

### Conclusions

(1) There is little palynological evidence which suggests that the samples derive from deposits that have been mixed, altered, or have otherwise lost integrity. There are three forms of such evidence. First, the observed pollen record presented no taxonomic evidence of recently introduced exotic flora. Second, the ostensible stratigraphic relationships of the samples (Table A.5.1) is such that the pattern of correspondence of pollen density with antiquity is a bimodal curve (although Unit 2 provides extreme values). One would expect mixed deposits either to have low pollen densities (viz., the sample from rodent-disturbed midden), or more variable pollen densities. Third, the character of the extracted fraction of the samples is not different - except as regards volume and pollen density. If the sediment sequence lacked integrity, one might expect it to reflect deposition of sediments from different sources, which could contain different kinds of plant cell fragments as well as different kinds of pollen.

(2) The pollen record does not suggest that a finer degree of chronological control can be obtained through pollen analysis than through the evidence of stratigraphic positioning. However, there is some suggestion that the intra-site relative stratigraphic position of a sample might be more precisely determined through pollen analysis than field information on

associated archaeological remains may allow. Since the pollen samples may be directly associated with the archaeological record, pollen analysis may aid resolution of a variety of chronological problems at the Calleguas Creek site, although it probably will not produce a pollen sequence record relevant to regional or inter-site chronology construction.

(3) The sample suite was too limited to allow for definitive paleoenvironmental reconstruction. The pollen records observed would be consistent with a reconstruction of a salt marsh environment. However, they are statistically different from the bulk of pollen records from Batiquitos Lagoon (Meyer 1979) and other coastal lagoon deposits in southern and central California (Mudie and Bynne 1980), or a surface sample from a salt marsh location in San Diego County (Hevly, personal communication). They are statistically similar to pollen records from the midden at the Late Archaic/Historic Kumeyaay site of La Rinconada de Jamo (Diggs and Hevly 1981). The former group of pollen records contain 40-70% of Cheno-am pollen, as a rule, but those from the occupation site contain 60-90%. Prima facie, the depositional paleoenvironment suggested by the pollen records is exactly that suggested by the material culture record: midden.

(4) The pollen record of the scrapings from stone items suggests that such samples are as relevant to analysis as any other samples from the deposits of this site. Presumably, scraping and pollen wash samples from manos would be equally analyzable. There is no direct evidence, though, that inferences about uses of ground stone items would be better informed by the analysis of the pollen of their scrapings or washes. Further, a statistically large number of such samples representing each class of ground stone artifact from each horizon of site occupation would be necessary to provide a palynological data base large enough to generate such inferences at a fully acceptable level of confidence. Given the particular field conditions at CA-VEN-110, the logistics of keeping such samples

uncontaminated seems to argue that more potentially profitable avenues of palynological research should be prioritized over this one.

My personal opinion is that a palynological study oriented toward intra-site stratigraphic control and paleoecosystem reconstructions is not only justified, but would prove archaeologically profitable at this site. However, a critical mass of research would be necessary to obtain sufficient control information and to generate the very large pollen counts (probably >1000 pollen observations per sample) that would be needed to vindicate the innovative methodological approaches needed for study of the sort of data occurring in these samples. In a University research setting, I would estimate this would require a year of effort.

#### References Cited

Diggs, Robert D., and R. H. Hevly

1981 Pollen Studies at La Rinconada de Jamo. Unpublished ms. on file, Department of Biological Sciences, Northern Arizona University.

Hevly, Richard H., and R. D. Diggs

n.d. Pollen Studies at Rancho San Diego. Unpublished ms. on file, Department of Biological Sciences, Northern Arizona University.

Meyer, M.

1979 Pollen Evidence for Historic Sedimentation Rates in Batiquitos Lagoon, San Diego County, California. Master's thesis, Department of Geography, University of California, Berkeley.

Mudie, P., and R. Byrne

- 1980 Pollen Evidence for Historic Sedimentation Rates in California Coastal Marshes. Estuarine and Coastal Marine Science 10:305-316.

Schoenwetter, James

- 1979 Archaeological Pollen Analysis of Copan Reservoir Sediment Samples. In Excavations in the Copan Reservoir of Northeastern Oklahoma and Southeastern Kansas, by S. C. Vehik and R. A. Pailles, Appendix 1. Archaeological Research and Management Center, University of Oklahoma, Research Series 4.

Woosley, Anne I.

- 1978 Preliminary Pollen Studies at Three Ventura County Sites (Ven-294, Ven-125 and Ven-375). In The Archaeology of Oak Park, Ventura County, California, edited by C. William Clewlow, Jr., H. F. Wells, and A. G. Pastron, vol. 2, pp. 203-215.

APPENDIX 6  
ECOFACT SUMMARY BY UNIT AND LEVEL

UNIT/ LEVEL	SHELL	BONE TOTAL	UNBURNED ROCK	FIRE AFFECTED ROCK	CHARCOAL
1/1	174.3	0.0	0.0	0.0	0.1
2	10.6	2.6	0.0	5669.0	12.1
3	4.5	0.8	0.0	0.0	14.0
4	0.0	44.0	0.0	0.0	0.0
5	0.0	15.6	0.0	0.0	0.0
6	9.0	0.8	0.0	8000.0	4.0
7	9052.5	31.9	0.0	211.7	5.2
8	16318.3	176.9	3500.0	13629.9	41.7
9	37348.6	160.6	468.6	86.2	391.9
10	30485.1	544.5	1449.4	187.8	125.0
11	6573.1	204.2	2315.2	0.0	113.7
12	8639.4	34.1	932.9	666.8	21.7
Subtotal	108615.4	1216.0	8666.1	28452.3	729.3
2/1	512.2	15.3	0.5	0.0	26.9
2	3.3	0.3	0.0	0.0	21.1
4	1.0	0.0	0.0	0.0	8.4
6	1404.3	58.0	0.0	0.0	35.1
7	3530.2	56.8	0.0	450.0	6.6
8	16000.0	510.6	500.0	48459.2	27.6
10	9400.0	25.0	43.0	1800.0	52.3
Subtotal	30851.0	666.0	543.5	50709.2	178.0
3/1	3500.0	57.3	0.0	293.6	13.6
2	1224.7	36.0	18.9	10.6	17.0
3	8273.9	220.5	1221.2	59.1	23.3
4	34564.5	292.4	1158.0	2007.4	35.1
5	23466.8	1034.6	713.2	188.1	25.2
6	20267.0	89.6	1599.6	0.9	44.6
7	20598.6	410.4	325.7	268.0	52.6
8	11880.1	119.9	351.4	7203.5	32.5
9	12043.2	63.6	1107.0	526.4	9.7
10	6350.4	60.2	378.2	430.5	11.2
11	4309.2	57.8	0.0	0.0	6.8
Subtotal	146478.4	2442.3	6873.2	10988.1	271.6
3E/1	2662.8	106.0	32.8	14.3	9.8
2	19400.0	92.5	787.0	543.9	36.6
3	1600.0	1178.7	471.6	153.2	8.8
Subtotal	23662.8	1377.2	1291.4	711.4	55.2

# APPENDIX 6 (continued)

4/1	1618.2	2.8	267.4	0.0	8.2
2	426.5	12.2	0.0	0.0	12.0
3	602.7	1.5	0.0	80.0	3.3
4	8183.9	100.7	0.0	317.3	32.8
5	1397.9	87.4	0.0	122.1	10.0
7	806.7	85.4	0.0	0.0	0.0
8	9803.3	101.5	42.2	103.9	36.8
9	10294.5	2981.4	0.0	670.0	37.4
10	9764.2	265.7	3000.4	0.0	67.9
Subtotal	42897.9	3638.6	3310.0	1293.3	208.4
5/2	4646.0	66.8	2430.0	168.4	1.9
3	15351.2	280.5	448.8	61.3	34.5
4	1567.4	22.9	68.7	5.9	3.2
Subtotal	21564.6	370.2	2947.5	235.6	39.6
6/1	2200.0	2.4	1700.0	0.0	10.5
2	3000.0	14.0	54.6	0.0	11.7
3	6804.2	70.0	277.5	157.2	4.1
4	8100.0	74.3	165.5	394.3	24.7
5	2200.0	14.8	49.3	0.0	12.9
Subtotal	<u>22304.2</u>	<u>175.5</u>	<u>2246.9</u>	<u>551.5</u>	<u>63.9</u>
Total	396374.3	8185.8	25878.6	92941.4	1546.0

# APPENDIX 7

## MOLLUSCAN REMAINS AT CA-VEN-110 AND CA-VEN-11

Present at CA-VEN-110

Present at CA-VEN-11\*

### Gastropoda

<u>Acmaea</u> sp.	x
<u>Allia carinata</u> (was <u>Mitrella</u> )	-
<u>Cerithidia californica</u>	-
<u>Conus californicus</u>	x
<u>Crepidula onyx</u>	-
<u>Crepidula perforans</u>	-
<u>Crepidula</u> sp.	-
<u>Crepidatella lingulata</u>	x
<u>Fissurella volcano</u>	-
<u>Forreria belcheri</u>	-
<u>Haliotis cracherodii</u>	-
<u>Haliotis</u> sp.	x
<u>Lamellaria diegoensis</u>	-
<u>Littorina planaxis</u>	-
<u>Littorina scutulata</u>	-
<u>Lottia gigantea</u>	-
<u>Mitrella tuberosa</u>	-
<u>Nassarius perpinquis</u>	x
<u>Norrisia norrisi</u>	-
<u>Olivella biplicata</u>	x
<u>Polinices lewisii</u>	-
<u>Polinices reclusianus</u>	-
<u>Polinices</u> sp.	x
<u>Sinum scopulosum</u>	-

Pelecypoda

<u>Astraea undosa</u>	x
<u>Argopecten aequisulcatus</u>	x
<u>Chama arcana</u>	-
<u>Chione californiensis</u>	-
<u>Chione fluctifraga</u>	-
<u>Chione undatella</u>	-
<u>Chione sp.</u>	x
<u>Donax gouldii</u>	-
<u>Lucinisca nuttalli</u>	-
<u>Macoma nasuta</u>	-
<u>Macoma sp.</u>	x
<u>Mytilus californianus</u>	x
<u>Ostrea lurida</u>	x
<u>Pecten sp.</u>	-
<u>Protothaca staminea</u>	x
<u>Saxidomus nuttalli</u>	x
<u>Septifur bifurcatus</u>	x
<u>Tagelus californianus</u>	x
<u>Tellina idae</u>	x
<u>Tellina sp.</u>	-
<u>Tivela stultorum</u>	x
<u>Trachycardium quadragenarium</u>	x
<u>Tresus nuttallii</u>	x

Other

<u>Brachyura sp.</u>	-
<u>Balanus tintinnabulum</u>	-
<u>Dendraster sp.</u>	-
<u>Dentalium neohexagonum</u>	-
<u>Mopalia muscosa</u>	-
<u>Pollicipes polymerus</u>	-
<u>Strongylocentrotus purpuratus</u>	-

\* Resnick 1980:131



APPENDIX B  
BONE SUMMARY BY UNIT AND LEVEL

Unit/ Level	Teleost	Elasmo- branch	Small Mammal	Large Mammal	Sea Mammal	Reptile	Bird	Human	Misc.	Total
1/1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	2.4	0.0	0.2	0.0	0.0	0.0	0.0	0.0	2.6
3	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
4	1.9	0.0	0.0	42.1	0.0	0.0	0.0	0.0	0.0	44.0
5	0.0	3.8	0.0	11.8	0.0	0.0	0.0	0.0	0.0	15.6
6	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.6	0.8
7	15.0	0.8	0.1	15.7	0.0	0.2	0.1	0.0	0.0	31.9
8	87.9	28.5	4.1	89.0	6.3	1.7	1.4	0.0	0.0	178.9
9	83.1	17.5	5.5	41.2	6.8	1.3	5.2	0.2	0.0	160.6
10	273.0	39.1	4.4	210.4	6.2	2.1	9.9	0.0	0.0	544.5
11	161.4	17.2	0.7	17.9	3.7	0.6	2.7	0.0	0.0	204.2
12	32.4	0.2	1.3	0.0	0.0	0.2	0.0	0.0	0.0	34.1
Subtotal	835.8	107.5	16.2	408.3	22.8	6.1	18.7	0.2	0.6	1216.0
2/1	1.8	0.4	6.3	2.7	1.0	0.0	0.0	0.0	3.1	15.3
2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	21.3	4.2	2.7	12.2	0.0	0.4	1.7	0.0	15.5	58.0
7	30.5	8.9	1.0	10.2	1.5	0.6	0.8	0.3	3.0	58.8
8	56.6	12.1	3.0	50.6	362.9	1.0	2.8	0.2	21.4	510.6
10	10.5	0.0	0.2	13.7	0.3	0.3	0.0	0.0	0.0	25.0
Subtotal	121.0	25.6	13.2	89.4	365.7	2.3	5.3	0.5	43.0	668.0
3/1	9.3	0.6	0.5	43.5	3.2	0.2	0.0	0.0	0.0	57.3
2	21.0	1.5	1.0	11.5	0.0	0.6	0.4	0.0	0.0	36.0
3	61.2	9.8	2.1	104.8	39.8	1.7	1.1	0.0	0.0	220.5
4	171.3	21.4	6.7	89.4	1.2	1.9	0.5	0.0	0.0	292.4
5	134.5	20.8	2.9	74.8	1.2	0.5	4.0	780.0	6.1	244.6
6	89.4	2.4	9.9	6.0	1.3	0.0	0.6	0.0	0.0	89.6
7	267.2	22.5	4.8	114.4	0.0	1.4	0.0	0.0	0.0	410.4
8	80.0	3.0	3.0	42.7	0.0	0.8	0.0	8.9	3.5	119.9
9	42.8	3.5	0.7	16.0	0.0	0.2	0.0	0.4	0.0	63.6
10	20.7	3.5	0.6	28.4	0.0	0.0	0.0	7.0	0.0	60.2
11	39.4	6.2	0.4	10.0	1.2	0.6	0.0	0.0	0.0	57.8
Subtotal	896.8	95.0	32.7	541.5	47.9	7.9	6.6	804.3	9.6	1652.3

APPENDIX B (continued)

3E/1	27.6	3.8	2.6	25.7	0.0	0.3	0.6	0.0	45.4	106.0
2	21.5	7.7	1.4	30.6	0.0	0.1	0.0	0.0	31.2	92.5
3	91.4	15.3	2.4	70.5	0.0	0.3	0.0	910.0	88.8	268.7
Subtotal	140.5	26.8	6.4	126.8	0.0	0.7	0.6	910.0	165.4	467.2
4/1	1.8	0.4	0.0	0.6	0.0	0.0	0.0	0.0	0.0	2.8
2	3.5	0.1	0.4	7.8	0.0	0.0	0.4	0.0	0.0	12.2
3	0.2	0.0	0.0	1.0	0.3	0.0	0.0	0.0	0.0	1.5
4	24.8	3.2	0.4	39.8	0.0	0.6	0.9	0.0	30.8	100.7
5	87.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	87.4
7	47.7	1.2	0.5	15.4	0.0	0.4	3.2	0.0	17.0	85.4
8	33.9	6.7	2.2	19.4	1.1	3.3	4.0	0.0	30.9	101.5
9	62.7	12.1	1.9	26.0	2810.7	0.8	0.0	3.6	63.8	2981.4
10	117.9	12.8	1.4	69.8	22.0	0.2	3.2	0.0	38.4	265.7
Subtotal	380.0	36.5	6.8	179.8	2834.1	5.3	11.7	3.6	180.8	3638.6
5/2	10.8	4.5	0.9	34.2	0.0	0.1	0.0	17.1	16.3	66.8
3	64.2	20.5	3.0	35.6	6.2	1.4	2.0	0.0	130.5	280.5
4	8.4	0.5	0.0	1.4	0.0	0.5	0.3	0.0	11.8	22.9
Subtotal	83.4	25.5	3.9	71.2	6.2	2.0	2.3	17.1	158.6	370.2
6/1	1.8	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	2.4
2	5.8	1.0	0.4	2.1	0.0	0.1	2.0	0.0	2.6	14.0
3	16.6	1.8	2.1	6.0	0.3	0.8	4.0	0.0	38.4	70.0
4	22.3	4.0	1.4	15.9	0.0	8.2	0.0	0.4	22.1	74.3
5	10.0	0.3	0.0	0.0	0.0	0.1	0.0	0.0	4.4	14.8
Subtotal	56.6	7.1	4.4	24.0	0.3	9.2	6.0	0.4	87.5	175.5
Total	2313.9	324.0	83.6	1441.0	3277.0	33.5	1751.2	38.1	625.5	8185.8

APPENDIX 9

RESEARCH DESIGN FOR CA-VEN-110

Submitted to:

Los Angeles District, Corps of Engineers  
300 North Los Angeles Street  
Los Angeles, California 90053

In partial fulfillment of Contract No. DACW09-85-C-0025

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July 1, 1985

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## RESEARCH DESIGN FOR CA-VEN-110

### 1. INTRODUCTION

The archaeological site designated as CA-VEN-110, located at Calleguas Creek, Ventura County, has been undergoing a variety of impacts for many years. The disturbance, displacement, and actual loss of cultural values has been a result of both natural and man-made forces. Since the site has already been determined eligible for the National Register of Historic Places (NRHP), the Los Angeles District, Corps of Engineers, now has need to know whether the archaeological resource retains: (a) its integrity; (b) potential scientific research value; and (c) continuing concern on the part of the local Native American people for the cultural and religious values contained. If these conditions are no longer met, the site would not be considered further eligible for the NRHP. If the earlier determination of significance is sustained, additional efforts may be necessary to preserve the scientific and cultural values demonstrated under the provisions of the National Historic Preservation Act, 33 CFR 325, 36 CFR 800, and the existing Memorandum of Agreement.

This document comprises the research design which will guide the testing program at CA-VEN-110. It begins with a cultural overview which includes regional and local summaries, and continues with a description of the environmental setting and the natural resources of the vicinity. The research questions are then developed on the basis of existing information. This section is followed by chapters which describe the data required to address the problems, and the methods to be utilized in the field work and laboratory analysis to interpret the results.

## 2. CULTURAL OVERVIEW

### Regional Synthesis

The most nearly applicable regional overview which has been synthesized for the general area is that of Leonard (1971); the dates and nomenclature of periods or phases differ from those formulated by Wallace (1955), King (n.d.), Chartkoff and Chartkoff (1984), but the essential sequence and reconstruction of the cultures are comparable. The greater Los Angeles Basin has a rich, uninterrupted cultural record extending back in time for perhaps 25,000 to 30,000 years. Although the evidence is still rare, the earliest inhabitants of the southern California region were probably big game hunters of the Pleistocene megafauna such as the mammoth. With the passage of time, climatic changes related to the recession of the Ice Age and possibly even the effects of human predation resulted in the extinction of the larger animals. This led to a change in human subsistence strategies from a big game hunting economy to a pattern characterized by the procurement of smaller game and the collecting of wild plants and seeds.

By about 10,000 years ago, sites representative of the new adaptation are evident all along the southern California coast from San Diego to San Luis Obispo Counties. Assemblages typical of this horizon are characterized by large milling stones and manos, simple percussion-flaked core tools, hammerstones, and such exotic items as discoidals, cogstones, and doughnut stones. Hunting continued as a supplemental, seasonal, or sporadic activity in a subsistence system primarily reliant on the gathering and processing of wild plants or the most accessible maritime resources. Ornaments or tools of bone and shell are relatively rare in these sites.

The so-called Intermediate, Transitional, or Middle Period, still poorly understood in the area, dated from about 1500 or 1000 B.C. to A.D. 500 or 800, depending on the author cited. Typical sites

reflect an increase in fishing and more hunting of both land and sea mammals. Although many artifacts (e.g., milling stones) and activities persist, the structural shifts in both resource exploitation and spatial organization led to the addition of certain new tool types indicative of utilization of a more diverse resource base (Leonard 1971:119). Typical artifacts are small, pressure-flaked projectile points which presuppose the advent of the bow and arrow, greater quantities of bone tools, and greater reliance on the mortar and pestle for processing vegetal foods.

The Late Horizon, from A.D. 500 or 800 to historical contact, is characterized by increasing complexity in both economic and social spheres. Sites along the coast tend to be large and deep, and probably represent the major, permanent village locations, in contrast to inland or upland sites which may be small, seasonal, temporary, or special purpose occupations. Such camps were often satellites of the main village's interaction sphere (Leonard 1971:122). Within the subsistence pattern, there was an intensification of exploitation of the local resources within the coastal, offshore, mountain, and interior environments. Social contacts and influences were accelerated through trade, ceremonial, and other interactions. In a recent synthesis, this period has been called the Late Pacific (Chartkoff and Chartkoff 1984:180-186) and interpreted as the culmination of all the antecedent economic, technological, and social traits.

At the beginning of the historical period, the immediate vicinity was occupied by the Ventureño Chumash, a Hokan-speaking people. Their economy was extremely focal, largely based upon offshore fishing and sea mammal hunting, and the seasonal collection of seeds, acorns, and shellfish. The most complex of the communities were those - largely on the coast - which served as trade, political, and ceremonial centers, in contrast to the more egalitarian peripheral camps (Chartkoff and Chartkoff 1984:181). The people were noted for their skills in working with shell and



wood, basketmaking, and in the construction and use of the plank boat (tomol). Greater detail and illustration of typical artifact assemblages may be found in such sources as Landberg 1965; Grant 1978; King n.d.; Hudson and Blackburn 1979, 1981; and many other general or site-specific references.

Social organization has been described as a moiety relationship among various lineages with political and religious associations. The secular hierarchy was headed by a village chief whose power fluctuated with his wealth or the influence of his lineage (King 1974), and the population was subject to both ascribed and achieved rankings of status. Ethnographic data attest to "guild-like" organizations consisting of craft specialists, such as the sinew-backed bow makers and plank boat makers and users (Hudson, Timbrook, and Rempe 1978). Major villages sometimes exerted political control over smaller settlements (Kroeber 1953). Chumash religious rites included mourning ceremonies, reburial, economic exchange, and the ritual "killing" of stone vessels with worship oriented toward a pantheon of astral deities including the sun, moon, principal stars and planets. By historical contact, the 'antap cult apparently governed both the religious and political spheres at the village, provincial, and perhaps even broader levels of organization (Blackburn 1975; Hudson and Underhay 1978).

There were at least seven provinces, each governed by a principal village (Hudson and Underhay 1978:29). The "Mugu Province" was between the "Ventura Province" and the "Malibu Province," with its capitol said to be at either Muwu (CA-VEN-11) or Simo'mo (CA-VEN-24). The Mugu and Malibu Provinces may have been aligned within a larger confederation known as Lulapin; this term seems to denote both a specific place, Point Mugu, and a larger geographic region of unknown boundaries.

### Local Background Information

The three largest archaeological sites in the immediate vicinity of Mugu Lagoon are CA-Ven-24 (Simo'mo), CA-Ven-11 (Muwu), and the site of present concern, CA-VEN-110, which has no known ethnographic name. All three are shell middens with associated cemetery components, and all have been sampled in varying degrees. The most extensive excavations have been conducted at Simo'mo and Muwu; the primary focus at the former was in the midden cemetery area, whereas both the cemetery and habitation area were investigated at the latter. The least is known about CA-VEN-110, and none of the three is fully reported.

Written documentation for Simo'mo consists of rough field notes (Los Angeles County Museum Field Party n.d.; Van Valkenburgh n.d.; University of California, Los Angeles and San Fernando Valley College Field Classes n.d.); student papers (Meighan and Handler 1956; Martz 1980); and Martz' doctoral dissertation which analyzes comparative mortuary data (1984). Written sources for Muwu include field notes (Van Bergen n.d.; Woodward n.d.); various brief, subject-specific articles (Walters 1929; Woodward 1929, 1930, 1933; Lyon 1937; Love 1979; Love and Resnick 1979); several student papers (Baker n.d.; Bley n.d.; Bonner n.d.; Carr n.d.; Henderson n.d.); two M.A. theses which focus on faunal remains, primarily fish and shellfish (Resnick 1980; Love n.d.); and the pending complete site report to be prepared by Love and Resnick. Selected, immediately pertinent data from each site are summarized below.

#### Simo'mo

Five shell samples obtained from the 1959 field class excavations of the northernmost portion of the Simo'mo cemetery were dated by radiocarbon to ca. A.D. 300-1300 (Martz 1984:31, Table 2, 154, 503). The most intensive occupation of the site seems to have occurred between A.D. 300-700, based on diagnostic artifact types from what is believed to be the densest portion of the cemetery

that was excavated in 1932 (Martz 1984:146, 154). Statistical analyses of a number of variables relating to status positions, as derived from mortuary practises and associated materials from five Santa Monica Mountains sites over a span of approximately 2000 years, seem to indicate that the same period, i.e., between A.D. 300-700, may represent a florescence of Chumash cultural and social development (Martz 1984:VII, 505).

In relation to several of the chronological sequences formulated for southern California cultural development (e.g., Wallace 1955:223; Nelson 1971:123; King n.d.), the occupation of Simo'mo would generally be classified as beginning around the middle to late years of the Middle Period, and terminating in the Late Period prior to European contact. However, there is the possibility that the time frame could be expanded, since the actual boundaries of the cemetery have never been fully established or tested (Martz 1984:156).

Some notes and cultural materials from Simo'mo are stored at Los Angeles County Museum of Natural History, although presently inaccessible due to remodeling (C. Rozaire, personal communication 1985). All skeletal remains have apparently been lost (Martz 1984:151).

#### Muwu

Fairly extensive excavations were conducted at Muwu between 1929 and 1932 by the Woodward-Van Bergen team as salvage operations related to the construction of Roosevelt Highway (now Pacific Coast Highway). The site was investigated again by UCLA and CSUN students in 1976-1978. Three radiocarbon dates derived from the latter field work suggest an occupation between ca. A.D. 1400-1600 (Resnick 1980:1). However, historic materials such as glass beads and metal objects and baptismal records from Mission San Buenaventura demonstrate that occupation continued at least into the early 1800s (Woodward n.d.). The date when settlement began is still unknown, but many researchers (Weide 1965; King,

personal communication 1985) believe that the site was settled well before A.D. 1400. Weide has suggested that older cultural deposits may be buried beneath landslide debris closer to the toe of the mountain (1965).

Numerous artifacts, abundant ecological remains, and features such as house floors and burials have been recorded, although no comprehensive report has yet been prepared (Resnick 1980:24). The assemblage is said to contain a very broad range of tools related to subsistence activities, ecofacts, and artifacts interpreted as indicators of status or ritual.

Some cultural materials and notes concerning Muwu are in storage at Los Angeles County Museum of Natural History.

#### CA-VEN-110

Very little information is available from the various tests, excavations, and surveys which have been conducted at CA-VEN-110. The investigations listed below have not resulted in data useful in projecting spatial dimensions (horizontal or vertical), chronological placement, site function, length of occupation, extent or direction of change through time, or an evaluation of the degree of disturbance. Prior field work is summarized as follows:

1959 - E. Beechert (Ventura College). Limited field class excavation of a portion of the cemetery toward the southern end of the site. R. O. Browne apparently removed some burials from this, or another, area.

1974 - R. O. Browne. Surface survey and backhoe test trench into the east bank of Revolon Slough adjacent to CA-VEN-110.

1975 - F. Briuer and M. McIntyre (Northridge Archaeological Research Center [NARC], California State University, Northridge). Surface survey and limited subsurface

assessment to determine spatial extent.

1978 - A. Kirkish (Ventura County). Monitored removal of overburden sediment accumulation in Calleguas Creek.

1980a - C. Singer and G. Romani (NARC, Project VS 80). Surface survey of CA-VEN-110 and adjacent Revolon Slough area. Backhoe test trenches along Revolon Slough, limited exploratory shovel probes, and mapping of artifacts and features along the west bank of Calleguas Creek.

1980b - C. Singer and G. Romani (NARC, Project VS 80). Surface survey and systematic posthole testing through sediment overburden to locate upper surface of midden and horizontal extent of the site.

During these projects and over the span of years since the studies began, different portions of the site were periodically visible or inundated as a result of the changing vegetation, siltation, water level fluctuations, and changes in the number and configuration of water channels through the site.

Some bead data from the 1975 and 1980a/b investigations, together with a few photographs and descriptions of artifacts recovered by Ventura College in 1959, have been interpreted as typical of an occupation beginning around the end of the Middle Period and continuing into the Late Period, possibly even into the beginning of historical occupation. This span would be the approximate equivalent of Phase M5 (A.D. 900-1150) to Phase L2b (A.D. 1650 to 1782), with a possible continuation into Phase L3, or A.D. 1782-1804 (Singer and Romani 1980b:64).

CA-VEN-110 appears to have been a large, shell midden habitation site with an associated cemetery. In the burial area, Beechert (1959) reported observing two midden components separated by a sterile sand lens of undisclosed thickness. It has been proposed

that the upper midden stratum represents a Late Period affiliation, while the lower component represents the Middle Period. However, this phenomenon has been observed only in this area, and has not yet been documented elsewhere in the deposit (Singer and Romani 1980b:7).

Based on the incomplete and unsystematic records to date, artifact classes noted include food processing implements (ground stone bowls, mortars, pestles, and manos); very few hunting or fishing tools; some flakes and flaked tools; one core tool; shell and stone beads; fish and mammal remains. The catalogue of all known materials recovered, observed, and reported from field work during 1959, 1975, and 1980a/b is provided as Appendix 1. Despite diligent search, the only collection located consists of the materials derived from the 1980 test programs which are curated at California State University, Northridge. Artifacts from the 1975 NARC investigation, including shell beads, were reburied at the site at an unrecorded location (R. Wessel, personal communication 1980; A. G. Toren, personal communication 1985). The whereabouts of the 1959 field school collection and the artifacts and skeletal material excavated by Browne are unknown; it is said that human remains were reburied by Native Americans, and one stone bowl is curated at the Ojai Museum (P. Aiello and R. O. Browne, personal communications 1985).

Based on currently available information, it appears that there is some degree of contemporaneity, or chronological overlapping, of CA-VEN-110 and Simo'mo prior to the postulated abandonment of the latter. Although the earliest settlement of Muwu has not been established, this site may have been occupied at the same time as CA-VEN-110 into the Late Period and early historic years. The date proposed for the abandonment of Simo'mo, ca. A.D. 1300, correlates to the earliest dates suggested for Muwu. The absence of collections or data from the early field work, focus upon mortuary components, delay in issuing the Muwu site report, and problems related to the limited sampling of previous

investigations combine to inhibit synthesis or further interpretation of the existing, fragmentary information.

### 3. ENVIRONMENTAL SETTING

#### Geomorphology

The Mugu Lagoon and adjacent areas of interest to this study are situated in the southeastern edge of the Oxnard Plain, a portion of a subaerial and submarine deltaic complex, west of the westernmost extension of the Santa Monica Mountains (Warne 1971:2). From at least 65 million years ago and continuing to the present, the Ventura Basin has been marked by extensive tectonic activities (both uplift and subsidence), sea level changes, erosion and sedimentation processes. During the middle of the Pleistocene and earlier geologic time, the Ventura Basin was periodically inundated by shallow seas. Toward the end of the Middle Pleistocene, the southeastern portion of the Oxnard Plain subsided, whereas the northwest area was generally uplifted, causing the Santa Clara River to shift to its present, more northwesterly course (Steffan 1982:10-14, Figure 4).

Deposits within the lagoon areas represent a complicated sequence of marine, fluvial, and probably lagoonal sediments that were developed, eroded, and redeveloped during the complicated sea level fluctuations of the Pleistocene (Warne 1971:13). Some evidence suggests that:

...the deltaic-like Oxnard Plain was extended seaward by large quantities of sediment provided by the Ventura and Santa Clara Rivers. The sediment may have been swept eastward by long-shore currents, as happen today, forming a large embayment between the mouth of the Santa Clara River and the Santa Monica Mountains. This embayment might have then gradually filled to become the Mugu Lagoon of historic times (Warne 1966:43).

The situational processes beginning around the end of the Middle Pleistocene involved the lowering of sea levels, in conjunction



with the development of a barrier beach along an area of subsidence that conformed to the configuration of the coastline. This ultimately resulted in the recent lagoon about 3000 years ago (Steffan 1982:14, 49).

Originally, Mugu Lagoon seems to have paralleled the coast for approximately 10 km behind the modern beach-dune system, and extended 1-3 km inland to the Oxnard Plain, west of the Calleguas Creek drainage point, as illustrated in the 1857 USGS survey map T893 (Warne 1971: 6, Map 3). Both natural sediments and modern land filling by the U. S. Navy have reduced the extent of the original lagoon and its tidal creeks, primarily in the western and upland areas. The original area of tidal inundation for the lagoon has decreased from about 2000 acres to approximately 700 acres (Steffan 1982:51-52, Figure 16).

Although some researchers (e.g., Van Valkenburg 1933; Brown 1967:11; Martz 1984:146) have suggested that Mugu Lagoon extended inland as far as 3 km toward the margins of Simo'mo, during the time of its occupation, and then eventually retreated back to its historic configuration, this scenario of events post 3000 B.P. has not been scientifically investigated or documented (Steffan, Warne, personal communications 1985).

#### Geology

The Oxnard Plain is generally composed of "younger" or recent alluvial materials, including clay, silt, sand and gravel, which are unconsolidated and poorly stratified to well stratified. These areas include alluvial fans, flood plains, and streambed deposits. The adjacent part of the western Santa Monica Mountains, east and northeast of CA-VEN-110, consists of areas of Lower Miocene Marine Sedimentary rocks and the Middle Miocene Marine Topanga Formation (shale, sandstone, and some conglomerate arkose); Miocene Conejo Volcanic materials (basalt flows and breccia, andesite, arkose, and tuff); and Tertiary Intrusive basalts and diabase of Middle Miocene (?) age (Geologic Map of

California, Los Angeles Sheet 1969).

#### Soils

Five basic soil types were delineated within the Mugu Lagoon by the USDA Soil Conservation Service in 1970. They are described as follows by Gray and Steffen (1982:7, Figure 2):

**Camarillo Series.** Poorly drained sandy loams and loams, 60 in or more deep. They are derived primarily from sedimentary rocks, formed on alluvial fans and plains, and in stratified alluvium. These soils are also found just north of Pacific Coast Highway, to the west and east of the very southern end of the Calleguas Creek and Revolon Slough levees.

**Pacheco Series.** Poorly drained silty clay loams, 60 in and more deep. They formed in basins or on alluvial plains, in stratified alluvium, and are primarily derived from sedimentary rocks. Pacheco silty clay loam is also found north of Pacific Coast Highway on either side of the levees, near their southern end.

**Coastal Beaches.** Areas of narrow sandy beaches and adjacent sand dunes where drainage is excessive to poor.

**Fill Land.** Areas of soils that have been mechanically mixed and have no discernible horizons, and/or areas which have have been artificially transported from ocean or local stream dredgings. They may also contain modern debris or rocks.

**Tidal Flats.** Material consisting of highly stratified thin lenses of very fine sandy loam, silty loam, clayey loam, and clay. They are found in nearly flat coastal areas that are periodically covered by tidal waters.

### Calleguas Creek

Prior to channelization and other modifications of the area, Calleguas Creek and Revolon Slough were normally intermittent streams which carried large volumes of water only during winter storms. The Calleguas watershed, which includes the Slough, originates from the Simi and Conejo Valleys to the north and east, and encompasses approximately 208,200 acres. The two drainages were channeled and extended to curtail flooding and divert runoff waters into Mugu Lagoon. Because of the amount of fresh water thus directed, the lagoonal environment has changed to an estuarine condition. Calleguas and Revolon now flow as perennial streams which serve to drain agricultural lands and treated sewage (Gray and Steffen 1982:3).

Steep mountains composed of highly erosive clays, silts, and sandstones subject to infrequent, but heavy, rains characterize the upper watershed. This topography, together with the changes in land use, has created accelerated rates of erosion. Increased amounts of sediments are reaching the Lagoon, reducing its size and changing the habitat types. Much of the sediments also accumulate within the Calleguas Creek channel (Gray and Steffen 1982:3).

Originally, Calleguas Creek emptied onto the Oxnard Plain somewhere between Somis and above Mugu Lagoon (Warne 1971:6; Steffen 1982:14). Apparently there was no defined channel south of the Highway 101-Camarillo area, and Beardsley Wash emptied into fans above the area of Revolon Slough onto the Plain (Hausner 1975; Steffen 1982:14). The drainage waters from Calleguas may have flowed against the base of the mountains and passed on the east side of Round Mountain (Hausner 1975).

As agriculture increased in the 1860s and expanded to the eastern areas of the Oxnard Plain, local farmers were plagued by the flooding from the Calleguas drainage. Beginning about 1884 to 1892, residents began to clear a straight channel from the

present alignment of Highway 101 to the Conejo Creek junction (Hausner 1975; Steffen 1982:20). A leveed channel from Conejo Creek and Lewis Road was constructed about 1923, while local oil companies were trying to channelize portions of the creek in 1919-1920. In 1924, Revolon Slough was dug to provide drainage, and levees were built from around Lewis Road, some 4000 ft downstream, just past the crossing at Hueneme Road (Hausner 1975; Steffen 1982:20). Lower Calleguas Creek was channelized to prevent flooding in 1926 (Steffen 1982:Table 1), and in 1931 the Broome Ranch together with a local sugar company constructed levees from about 4000 ft downstream of Hueneme Road to the Coast Highway. The elevation of the channel bottom was the same as that of the adjacent Oxnard Plain.

Levee material for these installations was obtained from agricultural drainage ditches and later from sediments within the Calleguas channel. The splitter levee that separates Calleguas Creek from Revolon Slough was built in the 1950s from creek bed materials (Al Duff, personal communication 1980). Some areas in the southern portions of the Calleguas Creek and Revolon Slough levees have been observed to contain cultural materials, most likely originating from CA-VEN-110 (Singer and Romani 1980a:40).

When the runway on the U. S. Naval Reservation at Mugu Lagoon was expanded in 1953-1954, much of the fill came from Calleguas Creek on the Rancho Guadalupe, sold by Broome. Further modifications of the watershed began in 1961, with approximately 180,000 cubic yards of material originating between Broome Ranch Road and Hueneme Road used as part of construction fill. In 1966, construction for the Revolon Slough and Beardsley Wash watersheds was authorized, and this work is still in progress. An additional 150,000 to 200,000 cubic yards of fill material was removed from Calleguas Creek for the Southern California Edison Osmond Beach electrical generating station in 1968. Union Oil Company apparently did some channel shaping, crossing grade stabilization, and survey work for Broome in exchange for the

fill. In 1969, workers from Chadwick and Buchanan removed another 419,800 cubic yards of accumulated sediments that resulted from heavy rains, and deposited the material at "Point Mugu" (Hausner 1975). Since then, at least two more sediment removal operations have followed, with archaeologists monitoring the work in the vicinity of CA-VEN-110 (Kirkish 1978; Romani 1980). At present, outlet work and construction of a new Caltrans bridge on the Pacific Coast Highway, from Revolon Slough to Mugu Lagoon, are in progress.

It is not presently known what the full impact of all these modifications has been to the site, although clearly the combined effects of channelization, silt removal, and erosion have served to alter the landscape from the configuration suggested by the early historical maps. CA-VEN-110 may have originally been situated on a slightly higher marine terrace. Estimates of the original surface level might be calculated from comparing the elevations of the adjacent areas to the east and west, since the elevation of the creek bed at the time of the 1931 channelization was said to be the same as that of the adjacent Oxnard Plain.

#### Vegetation

The four distinctive vegetation types that presently occur in Mugu Lagoon are as follows (Gray and Steffen 1982: 13-14, Fig. 1, Table 2):

1. Upland: The predominant plants in areas above tidal influence, from Mean Sea Level (5') and above, primarily located at the north end of the lagoon by Highway 1, are quailbush (Atriplex lentiiformis) and coyotebush (Baccharis pilularis var. consanguinea, in that order.

2. Intertidal Salt Marsh: The species that occur in the salt marsh are zoned mainly by frequency and duration of tidal flooding, and to a lesser extent, by sediment type and drainage patterns. A typical plant of this area is cordgrass (Spartina foliosa). However, this plant is found only in isolated areas and in two stands of approximately less than two acres each in the central arm of the lagoon.

Pickleweed (Salicornia bigelovii) and saltwort (Batis maritima), two low ground cover plants, occur in a narrow strand at the Mean High High Water level (MHHW). Above the MHHW level occurs another type of pickleweed (Salicornia virginica), with interspersed growths of California seablite (Suaeda californica) and sea lavender (Limonium californicum). At higher elevations the predominant plants are salt grass (Distichlis spicata) and glasswort (Salicornia subterminalis). Within these higher elevations occur shallow depressions of salt pans, where both species diversity and ground cover are minimal.

3. Submerged Aquatic (subtidal): The two dominant plants of this zone are eelgrass (Zostera marina) and ditch grass (Ruppia maritima). The former, which covers most of the subtidal ponds, is believed to have been an important economic plant to the coastal Chumash. It is positive that the thatch used was Zostera marina, commonly called sea tape. Compact masses of the material were encountered in various places over the floor. The angle in which the sea tape lay gives the impression of a fallen roof (Van Bergen n.d.:103).

Green algal and phytoplankton are two additional important and widespread submerged aquatic plants.

4. Sand Ridges: Sand ridges inland from the coastal beach support saltgrass (Distichlis spicata), sand verbena (Abronia maritima), shore sandbur (Ambrosia chamissonis), white leafed saltbush (Atriplex leucophylla), beachgrass (Ammophila arenaria) and ice plant (Mesembryanthemum edulis); the latter two species are more recently introduced.

A marked change occurring in Mugu Lagoon is the spreading of the marsh. This can be seen by comparing the 1857 USGS topographic map to recent maps, and is due to sedimentary infilling (Warne 1971:56, Map 3). Areas north of the lagoon are now largely comprised of low growing agricultural crops, along with some citrus orchards. Within Calleguas Creek, various fast growing riparian species, such as mulefat, abound, but are short lived due to periodic sediment overburden removal operations within the creek channel. Juncus grass was one of the important economic plants said to occur abundantly within the area of Simo'mo (Van Bergen n.d.), and the large area of "Juncae Grande" indicated on the 1874 "Map of Rancho Guadalupe," just north of the lagoon, may be juncus grass.

Some of the other plants mentioned by the Van Bergen 1932 expedition notes, within the vicinity of Simo'mo, are listed in Appendix 2.

Coastal sage scrub communities dominate much of the easterly adjacent Santa Monica Mountains region. Within La Jolla Valley, approximately two miles north of Muwu, is a woodland-park area. Some of the plant food resources listed for this generally flat grassy area - that also has a number of prehistoric sites - are acorns (Quercus agrifolia), sages (e.g., Salvia apiana and S. milifera), wild onion (Allium sp.), sugar bush (Rhus ovata), blue dick (Brodicea pulchella), wild rose (Rosa californica), and various grasses (Resnick 1980:11).

## Mammals

Thirty-three species of land and sea mammals have been observed at Mugu Lagoon (Gray and Steffen 1982:28). Most of the land mammals that inhabit the lagoon area, particularly the uplands but the salt marshes as well, are small, such as the house mouse (Mus musculus), western harvest mouse (Reithrodontomys megalotis), desert wood rat (Neotoma lepida), and the white footed deer mouse (Peromyscus maniculatus). However, larger mammals that usually inhabit the adjacent Santa Monica Mountains, such as mule deer (Odocoileus hemionus), are occasionally seen, and coyote (Canis laterans), gray fox (Urocyon cinereoargenteus), and the red fox (Vulpes vulpes) which is not native to this area, frequent and/or breed in the Mugu Lagoon vicinity (Gray and Steffen 1982:28).

Land mammals from the Santa Monica Mountains that have been found in local archaeological sites (e.g., CA-VEN-100, -11, and -24) include the following:

Grizzly bear - Ursus arctos (VEN-100 only)

Mule deer - Odocoileus hemionus

Coyote/domestic dog - Canis sp.

Cottontail rabbit - Sylvilagus sp.

Ground squirrel - Citellus beecheyi

Meadow vole - Microtus californicus

Wildcat - Lynx rufus

Jackrabbit - Lepus californianus

(Simons 1979:56, 69, Table 3, Los Angeles County Museum Field Party n.d.; Resnick 1980:61)



Two of the sea mammal species that occasionally enter the lagoon are harbor seals (Phoca vitulina) and California sea lions (Zalophus californianus) (Gray and Steffen 1982:28). Additional sea mammals that have been recovered from the middens at Muwu and Simo'mo are listed in Appendix 3.

### Birds

In 1976, MacDonald (in Gray and Steffen 1982:27) reported that 191 species of birds had been observed at Mugu Lagoon. The greatest numbers and species types are normally found between October and April. Mugu Lagoon is within the Pacific Flyway migration corridor (Gray and Steffen 1982:27). An incomplete list of bird species recovered from the midden contexts at Simo'mo and Muwu is provided in Appendix 4.

### Fish

Estuary environments play an important role in the life cycle of many types of fish. While Onuf et al. (in Gray and Steffen 1982:21) do not believe Mugu Lagoon is a particularly important nursery and/or spawning ground for important economic fishes, others such as MacDonald (in Gray and Steffen 1982:21), do believe this is an important area. At least 36 species have been identified in the lagoon (Gray and Steffen 1982:21).

California halibut (Paralichthys californicus) and diamond turbot (Hypsopsetta guttulata) may enter the lagoon as fingerlings before returning to the ocean when about 6 in. long. Barred surfperch (Amphistichus argenteus) and starry flounder (Platichthys californicus) both breed in the lagoon. The lagoon probably contributes also to the large number of fish that can occur in the submarine canyon just offshore, since the large number of topsmelt that move in and out of the lagoon attract many predators (Gray and Steffen 1982:21).

A list of fish species found within the midden context at Muwu (with notations indicating which are lagoon dwellers) is included as Appendix 5. Twenty-seven species were identified from skeletal parts, but arrays derived from bone remains alone are regarded as fairly consistently underestimated. From fine screening of only a very small sample from Shisholop (CA-VEN-3), Fitch identified the otoliths of 45 species and further estimated that at least 10 to 15 additional species would be found present if more residue had been examined. Habits and habitats have definite implications for Indian fishing techniques and for seasonality as well. At Shisholop, computations of relative biomass suggested that three times as much protein was supplied by the most common fish (white croaker) as by the far more visible shell in a very dense midden (Greenwood 1979:passim).

#### Shellfish

More than 190 benthic invertebrates, with 33 species of gastropods and 40 species of pelecypods, have been identified in various areas of Mugu Lagoon. The greatest number of species are found below the low water mark, whereas less diversity occurs above the low water mark. Animal density also decreases in the upper reaches of the lagoon in the muddier substrates where there is less tidal circulation; there are greater numbers and types where flushing occurs in the lower reaches of the lagoon (Gray and Steffen 1982:18,21).

The four most prevalent shellfish species recovered from Muwu are Mytilus sp., Chione sp., Ostrea lurida, and Protothaca staminea (Resnick 1980:131, Fig. 15). The latter three are Mugu Lagoon dwellers. The Mytilis was not speciated; although M. edulis does inhabit the lagoon, M. californianus would most likely be found in rocky areas to the east. The two most common shellfish types recorded in the field notes from Simo'mo are Pismo clam (Tivela stultorum) and Pacific oyster (Ostrea lurida).

Appendix 6 lists shellfish species identified from Mugu Lagoon, with notations indicating the 18 varieties recovered from the midden at Muwu. Shellfish are sensitive to water, shore, and bottom conditions; the array and proportions of the 66 species identified at CA-VEN-3, on an exposed outer coast (Greenwood 1969:44-46), might be expected to differ from those gathered in Mugu Lagoon, and quantitative comparisons will be sought.

#### 4. RESEARCH ORIENTATION

##### Introduction

From what is presently known about CA-VEN-110, largely generalizations, the orientation of the research begins with a set of fairly broad questions and progresses to more specific and focused avenues of inquiry. The general questions are framed to satisfy the immediate objectives of the testing and to determine whether particular classes of information are present, and their associations and depositional context sufficiently intact, to address the second-level problem domains.

Beechert postulated that there were two midden components separated by a sterile sand stratum in the portion of the cemetery he excavated in 1959. His notes record a large, straight-sided stone vessel with inlaid rim, tubular steatite beads, shell beads, projectile points, bone fishhook, small basket mortar, fused shale flakes, and several flexed burials. Manuscript notes recognized as Browne's mention trade beads as well. In 1975, Briuer and McIntyre added burned and broken stone bowl fragments, flakes, and dense concentrations of shell and scattered human remains on the surface. Kirkish recorded several possible features and areas of dark, greasy midden in 1978. The 1980 sampling observed one area of possibly intact midden along the west bank of Calleguas Creek, possible patches dispersed upstream, and added a bone awl, tarring pebble, fused shale projectile point, a bowl, comal, mano, mortar and pestle, flakes and cores of basalt and chert, and additional shell beads to the inventory (Appendix 1). Almost none of this material is available for reference but, on the basis of notes and records alone, the assemblage seems typical of (a) a village, and (b) a fairly late period of occupation.

From this limited data base and some knowledge about the adjacent sites, it is possible to generate some testable questions about

past human behavioral systems and contribute to local chronology building and inter-site comparisons. The underlying theoretical orientation is based upon two assumptions: that it is possible to distinguish between a location devoted primarily to maintenance activities and one specialized in extractive activities, and that subsistence patterns have fundamental consequences upon settlement and social organization (Binford 1980). A maintenance site (village or base camp) is a place where relatively large numbers of people, probably differentiated by age and sex, lived for relatively long periods of time, carrying out a wide range of economic and social activities. Subsistence patterns are particularly crucial in an area where the environment may have changed during the span of prehistoric settlement around Mugu Lagoon, since temporal and geographic variability in the availability of food resources imposes disjunctions between where a group resides and where they need to be in order to procure their livelihood. Models of adaptation are reflected in Binford's distinction between "collectors" who tend to carry the resources to the consumers on the basis of specialized economic activities removed from the main habitation site, and "foragers" who tend to practice residential mobility (1980).

Such models, and the approach to be employed at CA-VEN-110, have been characterized as middle-range theory building (Raab and Goodyear 1984). The questions raised seek to develop "structural poses" of past hunting and gathering cultures as a middle stratum of theory between the high-order hypotheses about environmental influences and social evolution, on the one hand, and low-level technoeconomic studies of artifacts, on the other. The recovery, analysis, and interpretation of the data to be sought will constitute a major step toward placing the site into larger models of human ecology, such as those seeking explanations for settlement patterns, social evolution, and interactions between social and physical environments.

### General Questions

Research domains relevant to the archaeological testing of CA-VEN-110 range from general questions to more specific hypothetical statements regarding the nature (formation) and function of the site, its chronological placement, intra-site structure, subsistence base, ceremonial importance, culture change, and its inter-site relationships with the villages of Simo'mo and Muwu. The feasibility of testing the following questions will, of course, be determined by the limitations of the data base. The objective is to determine whether the classes of information required to test them are present. Research propositions which are found viable, even though they cannot be fully addressed within the constraints of the test excavation, will be formulated as hypotheses to focus a data recovery phase which will follow as mitigation of unavoidable impacts.

General level questions are most applicable to the test investigation since they may be addressed through basic levels of analysis: qualitative, quantitative, presence/absence, chronological placement, evidence of seasonality, etc. The more specific problem statements set forth in the following section of this chapter require a more rigorous analysis of the data base, and may be more hampered by data limitations. The general questions below are not, therefore, intended to explicate human behavior, but to establish and evaluate the parameters of the research potential in order to present at a later time, more explanatory models of human activity.

The questions are based upon the local and regional summaries provided above in Chapter 2, and the artifacts and other observations reported from earlier studies at CA-VEN-110 described at the beginning of this chapter. The developed midden and presence of a cemetery, plus records of assemblages related to hunting, ocean fishing, plant food processing, cooking, basket making, and lithic manufacture or maintenance, are regarded as possible indicators of a sedentary occupation, i.e., village.

Notes mentioning trade beads, inlaid straight-sided bowls, use of fused shale, basket hopper mortar, and tubular "steatite" beads underlay the operating assumptions that occupation of the site continued into the late period, and that it is reasonable to explore a relationship, either contemporaneous or sequential, to Simo'mo.

1. Did CA-VEN-110 function as a village, or was it a more limited site, e.g., specialized for ceremonial, procurement, or processing functions?

Research Expectations: If CA-VEN-110 was a village, the assemblage should reveal a full range of maintenance, processing, extractive, and ideotechnic artifacts and features. According to Binford (1980:17), sites of brief occupation and relatively specialized function exhibit a "fine grain" [limited] picture of artifact variability, whereas sites where a diverse range of activities took place over a longer period of time, i.e., a village, will present a "coarse grained" reflection of greater artifact and activity variability. Village sites in this area should contain a well developed midden, house floors, cemetery component, hearth features, and a relatively full array of status and religious items.

2. Was the use of CA-VEN-110 contemporaneous with the occupations at Simo'mo or Muwu ?

Research Expectations: The chronological relationship of the three sites can be investigated through either absolute or relative dating methods. The former can be accomplished by the radiocarbon dating of suitable organic samples recovered from stratigraphic or associational contexts. Relative dating may be derived from the comparison of temporally diagnostic traits or artifacts (e.g., shell beads, projectile points, mortuary practices), obsidian hydration measurements,

and potentially, environmental data.

3. Was there any demonstrable change in the function of the site through time?

Research Expectations: Any shifts in function, such as from satellite to village center, or extractive to maintenance, will be reflected in qualitative and quantitative differences in the artifact assemblage, and trends in the faunal and floral resource data.

4. Was utilization of CA-VEN-110 intensified on a seasonal basis?

Research Expectations: If the site was used on a seasonal basis, periods of most intense occupation will be revealed in the presence of temporally sensitive faunal or floral resources such as migratory birds, spawning fish, juvenile sea mammals, plant maturation cycles, etc. Physical characteristics of midden development may also suggest periods of abandonment through stratigraphic lensing.

5. Was there a shift in the subsistence base through time?

Research Expectations: A diachronic shift in preferred food resources will be manifest in qualitative or quantitative differences in the food remains recovered. Examples might include trends from terrestrial to maritime resources, shallow- vs. deep-water fishery, intensification or diversification of plant and animal foods. Such change will be reflected technologically as well, in the tool assemblage, and may be correlated to an evolving environment.

6. Is the midden (occupation area) temporally and functionally associated with the cemetery?



Research Expectations: Information which can be reconstructed about burial practices and grave associations from previous excavations and any which are encountered during the proposed test will demonstrate temporal correlations with chronologically diagnostic artifacts from the midden.

With the exception of Question No. 2 above, each of these research problems can be addressed from the results obtained from testing CA-VEN-110, without reliance on data from Simo'mo or Muwu not presently available. Only the investigation of contemporaneity or temporal sequencing between this site and its neighbors needs comparative information; this will be derived from available absolute or relative dates from the neighboring sites and assemblage reviews.

#### Specific Statements

The following statements are second-level postulates which require specific data sets, more intensive analysis, and greater comparison with Simo'mo and Muwu. They will not necessarily be fully addressed within the constraints of a testing program, but they are provided as examples of testable hypotheses which can be formulated if the requisite data are found to be present and intact. The degree to which the site has the potential to contribute to the solution of such specific questions will be one measure of its significance.

Statement 1. The population from Simo'mo moved to CA-VEN-110 ca. A.D. 1300 and continued there the previously defined cultural traditions and patterns of behavior.

Assumptions: Simo'mo was abandoned ca. A.D. 1300, and the most intensive use of CA-VEN-110 was thereafter. Any previous occupation at CA-VEN-110, as claimed by Beechert, was minimal, intermittent, or for a special function; this would be demonstrated by a fine grained, or limited, range of artifact variability. Burial practices of any later

component will be more highly developed and evince additional distinctions of status. The population shift will be evident in an increase of site size. Subsistence and mortuary patterns, artifact types and technology, features, and other aspects of the archaeological record attributed to the period of most intense occupation should be characteristic of the years after A.D. 1300.

Justifications: The problem addresses the issue of site formation and utilization, on the basis of chronological, social, and economic indicators which are presumed to be present. It requires absolute or relative dating of CA-VEN-110, and comparison of its assemblages with Simo'mo on the assumption that they will gradate into each other. This would be most evident in tool technology, burial associations, and subsistence resource orientation. It also requires that inferences be made about social complexity, since those who moved from Simo'mo would be expected to retain their status; this can be pursued through mortuary data and ideotechnic artifacts such as bone whistles or shell beads.

Test Implications:

Chronology - Absolute dates for the most intensive occupation, if suitable samples are recovered, will be A.D. 1300 or later. Temporally diagnostic artifact types such as shell and trade beads, projectile points, or fishhooks, and cultural phenomena such as mortuary practices, ritual artifacts, and status indicators will be comparable, or later, than those described at Simo'mo.

Environment - Plant and animal food remains from CA-VEN-110 will show the continuing exploitation of maritime, riparian, and avian resources demonstrated at Simo'mo, but individual species will be those typical of

the microenvironment after A.D. 1300. They reflect the evolution and changing configuration of Malibu Lagoon. If pollen taxa are found to be present, they may indicate a shift in available plant resources.

Site Size - The increase in population at CA-VEN-110 will be manifest in larger site size and greater midden, feature, and artifact density after ca. A.D. 1300. Cultural remains of any earlier occupation will reflect intermittent occupation, fewer burials, and less artifact variability.

Technology - The diversity and numbers of tools will be greater than at Simo'mo because the population is exploiting an expanded subsistence base. Manufacturing technology will be at the same, or greater, level of skill, although there may be a shift in tool types and functions. Lithic raw materials will include more of those regarded as characteristic of late prehistoric periods, such as fused shale and obsidian.

Ideotechnic - Burial practices will be highly developed with the same, or greater, evidence of hierarchical social organization.

Physical Attributes - If two components are indeed present, the later site occupation will cover a greater area and contain more features or burials because of the expanded population. Deposition will be thicker and more rapid than during any antecedent strata which may represent only intermittent site use.

Statement 2. The major settlement of CA-VEN-110 followed a change in the configuration and natural resources of the lagoon which prompted an increased orientation to a maritime subsistence base.

Assumptions: Social and spatial aspects of site location are directly related to the subsistence base. CA-VEN-110 has greater proximity to the coastline than Simo'mo, and established trends through time reflect increasing adaptation to maritime resources. As lagoonal or riparian food resources dwindled, the population diversified the range of natural resources exploited.

Justifications: The problem addresses essential relations between the site and the effective environment, and lays the foundation for formulating explicit models relative to cultural ecology and settlement pattern. Environmental data are potentially available from both documentary and archaeological approaches.

Test Implications:

Environment: Archival, ethnographic, and cartographic research will show changes in the configuration of the lagoon. Further evidence from the analysis of stratigraphic pollen samples will demonstrate a change in vegetation communities, and analysis of shellfish remains may demonstrate increasing sedimentation of the collecting habitats. Geomorphological analysis will confirm the deposition of sediments.

Faunal Remains: Food remains will demonstrate a shift in the species utilized. This may represent a broader subsistence base, as a wider environment was exploited; increasing reliance on maritime resources; and/or adaptive change within taxa, e.g., from mud flat to outer coast mollusca, or tidepool to deep-water fishery. Although comparative data may not be available at this time, it may be predicted that CA-VEN-110 will be intermediate between Simo'mo and Muwu in this trend.

Technology: There will be a greater quantity, diversity, and more advanced types of tools related to maritime adaptations than have been reported for Simo'mo. These include circular shell fishhooks, tomols, and other items related to fishing, hunting of marine mammals, and island trade, plus the artifacts required for their manufacture and maintenance.

Statement 3. CA-VEN-110 was a major provincial village.

Assumptions: A village is occupied for most or all of the year, and is perceived as a place of permanent settlement. It will be associated with other settlements in a complex network of economic, social, and ceremonial relationships which further imply a hierarchical internal organization.

Justifications: The statement is prompted by the presence of a well developed midden, cemetery, broad array of artifact classes, site size, and the features previously noted. Defining the role and importance of CA-VEN-110 would contribute highly significant information about the settlement pattern of the southern California littoral during the late pre-contact period, and the postulated provincial organization. Investigation would also provide evidence to test two social concepts which have been advanced: that ascribed status was not emphasized in Chumash burials until after A.D. 1600, and that religious practices began to decline about A.D. 1100 and decreased rapidly by A.D. 1600 (Martz 1984:505).

Test Implications:

Subsistence: Remains will include a wide variety of food resources, fire affected rock, and spatial differences in soil chemistry. Floral and faunal species will reflect the full range of seasonal availability, broad catchment area, and perhaps trade.

Technology: The assemblage will include both extractive and processing tools, together with the raw materials and artifacts needed for both manufacture and maintenance. Either raw materials or finished items may be non-local in origin, reflecting trade or exchange mechanisms.

Site Elements: Cultural features such as hearths, house depressions, activity or workshop areas, and one or more cemeteries will be present.

Ideotechnic: The cultural traditions, mortuary practices, and status differentiation documented for Simo'mo should be perpetuated at CA-VEN-110, but may be less intense or rigorously observed toward the closing years of the occupation. Grave goods attributed to any earlier occupation of the site will be more reflective of hereditary or religious status, while burials during the later or "provincial capitol" period will suggest ascribed status.

## 5. RECOVERY AND ANALYSIS OF DATA

### Field Methods

The methods to be used in the field test represent a mixed strategy devised for the maximum recovery of the kinds of data needed to satisfy the project objectives. All of the approaches described below will contribute to one or both of these goals: to determine whether the site contains classes of information needed to address important local and regional research problems, and if the cultural materials retain sufficient depositional integrity to support acceptable interpretations and conclusions.

The locations where each method will be applied reflect our best effort to reconstruct the provenience of prior observations and excavations. Most useful is the grid pattern of auger borings (Singer and Romani 1980a, 1980b); reference points established by the Ventura County Flood Control District at that time will be restaked as the first step in implementing the field program. Horizontal control is necessary in order to relocate boring stations where cultural remains were encountered, and reconstruction of the elevation then prevailing is important in predicting the top of the midden areas. Past and current observations will also be used to place the controlled hand excavation units; the primary focus will be along the west bank of Calleguas Creek where the 1980 study reported the presence of presumably intact midden. Details of the testing and purpose of each method follow.

### Site Mapping

The archaeological site map will incorporate the 1980 grid and add precise locations of all work undertaken by units, trenches, or augering, and all features or burials encountered. Bearings of cultural and natural features will be recorded by transit and stadia rod, 100 m metric tapes, and other appropriate equipment.

### Machine Scrapes and Trenches

Mechanical equipment will be used conservatively to remove silty overburden from areas to be sampled, provide stratigraphic profiles, and clear vegetation to permit examination of the surface. The equipment will be monitored at all times by senior members of the project team. Shallow scrapes will be made over potential areas of buried midden, with an auger team assisting by making test borings to re-establish contact with the deposit. Two trenches will be cut to provide the geomorphologist with profiles of stratigraphy and landform, and to determine if any deeper cultural deposits exist.

### Auger Tests

Borings will serve two objectives. In conjunction with the mechanical equipment, test cores will be used to establish contact with the upper surface of the midden to forestall any impact or intrusion upon the cultural deposit. A more systematic program of auger testing will be dispersed to help define the horizontal extent of the site, provide a relative measure of depositional density and complexity, determine if a lower, or more deeply buried, component is present, and establish the depth and thickness of strata. This information will guide the placement of the excavation units.

### Controlled Excavation

The hand excavation of 1 x 1 m units will provide the primary evidence of chronology, site complexity, stratigraphy, technology, subsistence practices, and integrity. The precise placement cannot be specified until differences between the 1980 contours and current surfaces are reconciled, but some or all of the controlled units will be excavated on the west bank of Calleguas Creek in the area designated as potentially intact midden on the 1980 map. The number of units completed will depend in part upon the depth of the deposit, presently unknown, and the anticipated difficulties in screening wet soils with high clay/silt content. The excavation goals cannot be expressed as a



percentage of total site surface or volume, since these parameters are not known. The objective is to excavate and process a minimum of four cubic meters, with the hope that this level of effort will fulfill the project purposes of testing the integrity and research potential of the site. The following procedures will be observed:

Excavation will be conducted in arbitrary 10 cm incremental levels except when natural or cultural strata can be defined.

Detailed recordation will include Level Unit Records with maps of all features and significant artifacts, and other forms (e.g., Feature or Burial Records, Photo Logs, etc.) as needed.

Soil will be dry screened through 1/8 in mesh to the maximum degree possible under prevailing conditions; if necessary, soil will be soaked and wet screened over 1/4 in mesh, with controlled volumes saved for air drying and dry screening. Smaller mesh sizes will be used on samples to test for otoliths and other very small remains.

All fire affected rock will be counted and weighed in the field, recorded on the Unit Level Record, and reburied.

All artifacts, flaked lithic material, animal bone, and ecofacts will be collected in marked level bags.

One liter soil samples will be taken from the NW corner of each excavation unit for soil chemistry and flotation.

Soil profiles, with Munsell color determinations, will be drawn of the wall which best represents the unit.

Excavation will be terminated at bedrock or 10 cm below the last level which contains in situ cultural material; auger tests will confirm the presumptive sterile base. Remains would not be considered as primary depositions if contained within rodent burrows, mixed with modern intrusions, or associated with visual evidence of disturbance.

All phases of excavation and other procedures, including features, visible stratigraphy, and natural landmarks, will be photographed, with use of Photo Log records.

Charred organic material of adequate size for radiocarbon assay or other suitable samples with cultural associations will be collected under sterile procedures. A Radiocarbon Data Form will be completed for each sample.

Any ground stone implements associated with plant processing will be immediately overwrapped and removed promptly from the field for technical analysis. The laboratory supervisor will be responsible for all special samples and procedures.

A magnetic sensitive tag suitably marked will be placed in the bottom of each unit, and the surface restored to the original contour.

Technicians in a temporary on-site laboratory will receive marked level bags from each unit or auger sample, and will sort the materials into appropriate categories, e.g., flaked or ground stone, unmodified shell, animal bone, beads, etc. Qualitative and quantitative data will provide immediate feedback for the guidance of the project manager and field director.

Any human remains encountered will be exposed with great care under the supervision of the osteologist and Native American monitor, so that position, associated artifacts, and other

details can be completely recorded. The osteologist will also supervise the screening and laboratory sorting to differentiate between animal and potentially human bone fragments.

#### Analysis of Data

Analytical methods are focused on those techniques most likely to provide data relevant to the research questions and to the evaluation of integrity. After the field work is concluded and materials sorted, technical studies conducted in the laboratory will focus on the approaches which will satisfy both objectives most efficiently. For example, chronological and palynological studies are relevant to both of these purposes. Analysis of soil chemistry will test for vertical and horizontal differentiation. Flotation will seek to recover small floral remains, fish bone and scales, and other micro data. Selected column samples used for pH and other testing will be wet screened through a series of decreasing mesh sizes and the residues examined. Columns subject to this level of processing will be selected after a review of all other data to maximize information return; micro-sorting is extremely time-consuming and will be done only in support of specific objectives. All columns not examined will be preserved for future study. All artifacts, debitage, faunal and other material retained for curation will be cleaned and catalogued.

Each class of data - faunal remains representing an excellent example - may be applicable to more than a single research question. The articulation of the analytical processes to the research domains is suggested in the following pages.

#### Chronology

The date of occupation is one of the outstanding data gaps pertaining to CA-VEN-110. Chronology building is an essential prerequisite to addressing several of the issues posed. Data requirements and temporal indicators have been suggested by Moratto (1984:162-165) with sequences developed from such sources

as Warren 1968, Grant 1978, and Martz 1984, and even more specific period ascriptions have been assigned by King (n.d.) to artifact or faunal assemblages such as shell beads or fish species. The basic aim of the study of chronology is to order past events, investigate cultural origins, study cultural influences, and estimate the rates and directions of cultural change. To the extent that reliable dates are available from neighboring sites, a basis for reconstructing settlement systems and land use patterns is established. Temporal information is also useful in explaining the relationship between cultural development and environmental changes. Dating methods applied will include both absolute and relative applications.

Up to four samples of suitable organic material will be submitted to Beta Analytic Inc. for radiocarbon dating. While this number does not provide a full suite of dates for both horizontal and vertical interpretation, the results will contribute to an absolute chronological placement of the site, presently lacking; to a relative sequence of occupation with Simo'mo and Muwu, which are better known; and to the assessment of site integrity based on the internal consistency and sequence of the dates to be derived. Ideally, the samples to be collected will have cultural associations, and will represent maximum horizontal and vertical distribution.

Any one approach to relative dating is less secure than radiocarbon, but congruence of the many possible avenues enhances the reliability of the conclusions. If any obsidian is recovered, it will be submitted to Thomas Origer (Sonoma State University) for rim hydration measurement and to Dr. Thomas Jackson for sourcing. Palynology, discussed in greater detail below in the remarks about Environment, can also contribute to relative dating if, for example, identified taxa reveal marsh or riparian species no longer present, or the introduction of cultigens in the midden strata. Statistical analysis of faunal remains, discussed below under Subsistence, may also indicate

changes in species utilized which can be correlated with known technologies which have been dated. It is likely that the most applicable approach to relative dating will be temporally sensitive artifacts such as shell beads or projectile points and the comparison of whole assemblages with other sites where chronology has already been established.

### Subsistence

Study of plant and animal food remains is an essential aspect of questions or models related to human ecology, site function, seasonality, activity areas, and inter-site relationships. To serve these objectives, the faunal analysis will be pursued beyond the identification to species and quantification of remains for the explicit purpose of deriving cultural implications. Shell samples will be quantified by weight and percentage of total, with figures presented as a proportion of total volume (per cubic meter), since volumetric statistics are essential for intrasite and intersite comparisons. Animal bone data will include quantifications by species, age, sex, elements present, sides represented, modifications, counts and weights per provenience as appropriate. Since fish remains are often underrepresented because of their fragility and small size (cf. Greenwood 1969), we will seek to augment the faunal array by fine-screening soil samples for otoliths.

It is only after such basic data are recorded that applied analysis begins. Bone counts have often been used in the past as the basis for quantification, but there are disadvantages to this approach in interpreting subsistence: food preparation habits which fragment the skeleton, redistribution of bones throughout or beyond the site as a function of dismemberment or social exchange, dispersion by animals, or other events after discard. Bone or shell counts are also subject to differential representation of the species. Weights alone are affected by many of the same distortions, in addition to other problems unique to this method such as the effects of fire, leaching, or

permineralization. The third measure often used for faunal arrays is the minimum number of individuals (MNI), but one of the underlying assumptions is that the entire animal was consumed on the site. A single element from one of the large marine mammals does not necessarily indicate that the entire animal was brought to the site, a proposition which can be tested by reference to the entire distribution of elements present. The reliance on MNI alone will also overemphasize the importance of small species, and will be overinfluenced by sample size. We recognize the dangers inherent in relying upon any single method, and if the recovered faunal sample warrants, will utilize appropriate checks to validate and interpret the data.

If the size of the sample permits, the raw data can be focused more critically on the research objectives by calculating the actual biomass represented by bones and shells. This differs from the older procedure of using live weight estimates. The application of allometric formulas and scaling provides a more realistic measure of the amount of biomass represented by the faunal remains recovered. The analysis will also examine measures of diversity and equitability in order to compare sites or loci within sites. Diversity is a measure of the number of species utilized, while equitability is a measure of the degree of dependence upon each of the species identified. For example, 20 resources may be present at both of two sites (diversity), but one group may be obtaining 80% of its caloric intake from only a few of the species, while the other group may utilize the same food resources more evenly (equitability). The interpretation of such indices will be conditioned by the size and nature of the samples recovered, but from even the few units to be examined, it should be possible to draw useful inferences and comparisons regarding the energetics of the subsistence changes (e.g., siltation or other induced species replacements), and potentially, cultural affiliations, site function, and seasonality. The same procedures and objectives, including measures of diversity and equitability, will be applied to any

ethnobotanical remains recovered by screening, flotation, or palynology.

If pollen is recovered, the taxa will contribute further data toward an expanded understanding of subsistence practices, as well as being useful in the interpretations of environment and possible changes, chronology, and site integrity. According to the methods recommended by Dr. James Schoenwetter, Arizona State University, ground stone wash samples will be wrapped as soon as excavated to protect surfaces against contamination, and removed promptly from the field. In the laboratory, the use surface will be washed with a jet of distilled water, using a sterile brush and dilute hydrochloric acid if necessary to extract sediment from the pores of the stone. The wash will be collected in a plastic container which has been rinsed with distilled water, and then transferred to a comparably prepared sterile glass or plastic bottle, with the addition of the same acid (if used), rubbing alcohol, or formaldehyde to inhibit the growth of mildew. These samples, plus sealed soil samples, will then be sent to Arizona under Restricted Entry permits for analysis. Dr. Schoenwetter has offered to curate all samples - beyond those which the budget will support at this time - for possible future studies.

Seasonality, which is a consideration in whether to interpret the site as a village or functional camp as well as an element in subsistence pattern, may be derived from the identification of migratory birds, juvenile sea mammals, spawning fish species, emergent antlers, or other remains indicative of age or season.

### Environment

Greater understanding of the landscape and factors which have altered it from prehistoric times down to the present will contribute to scientific research into aspects of cultural ecology, and evidence of disturbance and deliberate modification will be important to assessing site integrity. Archival, geomorphological, and archaeological research will focus upon the effective environment at the time CA-VEN-110 was occupied and seek to define any changes which may have influenced the formation, function, and abandonment of this site or of its neighbors. Documentary investigation will continue the efforts already begun to locate, interpret, and compare hand-drawn and cartographic maps, aerial photographs, and written records of the early configuration of Mugu Lagoon and the modifications which have occurred through both natural and human causes. The consultant in geomorphology will review pertinent professional literature. In the field, he will examine natural and erosional exposures, profiles revealed in the trenches and units, soils, depositional strata, and other geologic or hydrologic data. The morphologic studies will seek to interpret the sedimentary and pedologic sequences within the archaeological deposit, alluviation or scouring, and the evolution of the landscape as it affected human occupation.

Certain classes of archaeological data may also contribute to a reconstruction of the effective environment. If pollens are recovered by the procedures described above, they could provide a measure of the marshy or riparian conditions prevailing and the postulated retrogression of the lagoon. Shell species are revealing of their habitat; it is recognized that changes within indices of variability or equitability may be due to other factors such as depletion or exchange, but a marked shift over time in habitat groups, such as mud flat varieties to open coastal mollusca, may also be responsive to changes in the environment.



### Social Organization

Ethnographic, comparative, and archaeological data will be analyzed to provide the maximum insight into status ascriptions, mortuary practises, trade, and internal organization of the site. At present, the very fragmentary information about the burials previously recovered from CA-VEN-110 inhibits comparisons with the wealth of data from Simo'mo (Martz 1984). Browne's notes of his work in 1959 supply a few details about three burials he removed from an unknown location said to be "under water." All were flexed. Steatite and shell beads were associated with No. 1, a black chert, leaf-shaped projectile point with No. 2, and a bone fishhook and undescribed projectile point with No. 3. A "large number of beads" and a stone bowl were found in the vicinity. Burials 1 and 2 were superimposed, with No. 3 about 5 ft southeast. Browne noted a black fibrous material over and below Burial 1, and that it appeared to be contained within a pit. Artifacts reported, but not known to be associated with the burials, included a basket mortar, quartz crystal, burned rock, two trade beads, a flint drill, and a flake of Grimes Canyon fused shale.

Any human remains encountered during this investigation will be exposed with great care under the supervision of the osteologist and Native American monitor, so that all possible detail concerning position, mode of interment, and accompanying or associated artifacts can be accurately recorded in situ before any removal or disturbance. Comparisons of individual burials within the site will provide some measures of status, as well as demographic data about the population, possible pathologies, insights into diet and occupation-related musculature, and other information potentially derived from anthropometric measures and osteological analysis. Comparisons will be made to cemeteries from other sites to the degree that the data will permit.

If the assemblage provides such evidence, inferences about social organization can also be derived from such ideotechnic artifacts as bone whistles, certain types of money beads, or other items related to status or ritual. These may indicate the presence of persons of high rank within the village, and suggest the internal physical organization of living or activity areas. Horizontal, as well as vertical, analysis of cultural materials will be employed to reveal the possible presence of working loci through concentrations of lithic debitage, bead making detritus, bone awls, hearths, tarring pebbles, or other raw materials and byproducts. Economic organization may be suggested by evidence of canoe manufacture or the presence of exotic materials obtained through trade networks. If obsidian is recovered, the source will be identified.

#### Integrity

Many avenues of inquiry will converge in the assessment of site integrity, which bears directly upon its significance under the criterion of scientific research potential. Observations of soil profiles and the studies of the geomorphologist will contribute to this analysis by interpreting the processes of deposition and midden formation. The results of palynology, radiocarbon dating, and obsidian hydration measurement, together with any diagnostic artifacts, should help to determine whether the vertical sequences are internally consistent from oldest (lowest) to most recent (uppermost), or if horizontal stratification is present. If these measures are reversed or incongruously mixed without apparent explanation, it would be suggestive of serious disturbance or secondary deposition. Intrusive modern material found within the midden, or other indications of soil disturbance observed in the trenches or unit profiles would be further evidence that the deposit is not intact. If the cultural materials are found to be mixed or displaced to such extent that the loss of integrity would impair the potential of the site constituents to address the posed questions, the significance of the site in terms of its NRHP eligibility would have to be

reconsidered. Displaced, isolated, or mixed artifacts are not necessarily without research value, and the site as a whole might still retain cultural and religious values to the Native American community.

#### Summary

A set of first and second level research questions has been posed to organize the test investigation by emphasizing certain classes of information which will be sought and the methods which will be employed to recover and analyze the required data in order to meet the objectives. It is not likely that all - or even, most - of the questions can be answered within this phase. Unfortunately, almost all of the information, records, and materials recovered from CA-VEN-110 over the course of many years have been lost to study, and an untold quantity of additional material has been removed or displaced from the surface or disappeared during the many activities which have so greatly modified the area. Any artifacts or collections which can be located will be included within the analysis, but essentially, the excavation of CA-VEN-110 starts anew.

The relevance of the research design is thus not so much the expectation that the specific questions will be answered during the test phase, but that the excavation and analysis are specifically focused to determine whether the site contains the cultural materials necessary in order to address the problems and data gaps identified. If so, and if the integrity is not so greatly impaired as to negate scientific inquiry and valid conclusions, then CA-VEN-110 will be found to retain its potential to yield important information. As a significant site, since preservation is apparently not a feasible alternative, mitigation by means of data recovery would then proceed to fulfill any unattained goals of the research design by additional excavation.

## 6. REFERENCES CITED

### Literature

Baker, Jonis

- n.d. Plant Food Resources at a Coastal Chumash Site. Unpublished seminar paper (1978) on file, Department of Anthropology, University of California, Los Angeles.

Beechert, Ed

- 1959 Field Notes, Field Class Excavation of VEN-110, Spring. On file, Los Angeles County Museum of Natural History.

Binford, L. R.

- 1980 Willow Smoke and Dogs' Tails: Hunter-gatherer Settlement Systems and Archaeological Site Formation. American Antiquity 45[1]:4-20.

Blackburn, Thomas C. (editor)

- 1975 December's Child: A Book of Chumash Oral Narratives. University of California, Berkeley.

Bley, Karlene

- n.d. The Beads of Muwu: A Late Coastal Chumash Village. Unpublished seminar paper (1980) on file, Department of Anthropology, University of California, Los Angeles.

Bonner, Wayne

- n.d. Comparison of Shell Components from Two Column Samples from Ven-11. A Test of Standard Column Sample Methodology. Unpublished seminar paper (1980) on file, Department of Anthropology, University of California, Los Angeles.

Briuer, Frederick, and Michael McIntyre

- 1975 Assessment of the Archaeological Impact on Revolon-Beardsley Projects. Unpublished EIR (VS-80) on file, Northridge Archaeological Research Center, California State University, Northridge.

Brown, Alan K.

- 1967 The Aboriginal Population of the Santa Barbara Channel. Archaeological Survey Reports 69:1-99. University of California, Berkeley.

Browne, Robert O.

- 1959 Field notes. Included in Beechert 1959.

- 1974 Letter to Jim Quinn, Deputy Director of Flood Control, Ventura County Public Works Department. On file, Ventura County Flood Control District, Ventura.

California State University, Northridge

- var. File of notes, correspondence, and reports relating to Ven-110. VS-80 on file, Center for Public Archaeology, Northridge.

Carr, Dianne

- n.d. Shell Ornaments, Pt. Mugu - Ven-11. Unpublished seminar paper (1979) on file, Department of Anthropology, University of California, Los Angeles.

Chartkoff, Joseph L., and Kerry Kona Chartkoff

- 1984 The Archaeology of California. Stanford University, Stanford.

Grady, Mark A.

- 1977 Research Designs and Cultural Resource Management: Some Practical Considerations. In Proceedings for 1977 of the American Society for Conservation Archaeology, pp. 43-49.

Grant, Campbell

- 1979 Eastern Coastal Chumash. In California, edited by Robert F. Heizer, pp. 505-508. Handbook of North American Indians, vol. 8, William G. Sturtevant, general editor. Smithsonian Institution, Washington, D. C.

Gray, Randall L., and Lyle J. Steffen

- 1982 Environmental Assessment: Revolon Slough Outlet. Report on file, U. S. Department of Agriculture, Soil Conservation Service, Davis.

Greenwood, Roberta S., and R. O. Browne

- 1969 A Coastal Chumash Village: Excavation of Shisholop, Ventura County, California. Memoirs of the Southern California Academy of Sciences, vol. 8.

Harrington, John P.

- n.d. Notes. Copies on file, Chester D. King, Thomas Blackburn, and Robert Edberg.

Hausner, Don

- 1975 Memorandum: History of Calleguas Creek, F2 III. Notes on file, Ventura County Flood Control District, Ventura.

Henderson, Theodore C., Jr.

- n.d. Faunal Analysis of Mammalian Remains Found During Archaeological Excavations at Pt. Mugu, California. Unpublished seminar paper (1980) on file, Department of Anthropology, University of California, Los Angeles.

Hudson, Travis, and Thomas C. Blackburn

1979 The Material Culture of the Chumash Interaction Sphere. Volume I: Food Procurement and Transportation. Ballena, Los Altos.

1983 The Material Culture of the Chumash Interaction Sphere. Volume II: Food Preparation and Shelter. Ballena, Los Altos.

Hudson, Travis, Janice Timbrook, and Melissa Rempe (editors)

1978 Tomol: Chumash Watercraft as Described in the Ethnographic Notes of John P. Harrington. Ballena Press Anthropological Papers 9.

Hudson, Travis, and Ernest Underhay

1978 Crystals in the Sky: An Intellectual Odyssey Involving Chumash Astronomy, Cosmology and Rock Art. Ballena Press Anthropological Papers 10.

King, Chester D.

1974 The Explanation of Differences and Similarities Among Beads Used in Prehistoric and Early Historic California. In 'Antap, edited by L. J. Bean and T. F. King, pp. 75-92. Ballena Press Anthropological Papers 2.

n.d. The Evolution of Chumash Society: A Comparative Study of Artifacts in Social System Maintenance in the Santa Barbara Channel Region Before AD 1804. Draft, unpublished Ph.D. dissertation, Department of Anthropology, University of California, Davis.

Kirkish, Alex

1978 Field Notes Taken While Observing Debris Removal Operations at VEN-110. Ms. on file, Ventura County Flood Control District, Ventura.

Kroeber, Alfred L.

- 1953 Handbook of the Indians of California. Bureau of Ethnology Bulletin 78. Smithsonian Institution, Washington, D. C. (Reprint of 1926 edition.)

Landberg, Leif C. W.

- 1965 The Chumash Indians of Southern California. Southwest Museum Papers 19.

Leonard, N. Nelson

- 1971 Natural and Social Environments of the Santa Monica Mountains (6000 B.C. to A.D. 1800). Archaeological Survey Annual Report 13:93-135. University of California, Los Angeles.

Los Angeles County Museum Field Party

- n.d. Unpublished field notes on the excavation of Simo'mo in 1932. On file, Los Angeles County Museum of Natural History.

Love, Doris Holly

- 1979 Marine Subsistence at Muwu. Journal of New World Archaeology 3[4]:44-57. Institute of Archaeology, University of California, Los Angeles.

Love, Holly, and Rheta Resnick

- 1979 Muwu - After Forty-Five Years in Storage. The Masterkey 53[1]:10-19.

Lyon, Gretchen

- 1937 Pinnipeds and a Sea Otter from the Point Mugu Shell Mound. Publications of the University of California at Los Angeles. Biological Sciences 1[8]:133-167.



Martz, Patricia Carol

1979 An Investigation of Chumash Social Organization Using Mortuary Data from Simo'mo. Ms. on file, Department of Anthropology, University of California, Riverside.

1984 Social Dimensions of Chumash Mortuary Populations in the Santa Monica Mountains Region. Unpublished Ph. D. dissertation, Department of Anthropology, University of California, Riverside.

Meighan, Clement W., and J. Handler (editors)

1956 Excavation of Site VE-26, Ventura County, California. Anthropology 196 class. Ms. on file, Department of Anthropology, University of California, Los Angeles.

Moratto, Michael J.

1984 California Archaeology. Academic Press, Orlando, Florida.

Raab, L. Mark, and Albert C. Goodyear

1984 Middle-Range Theory in Archaeology: A Critical Review of Origins and Applications. American Antiquity 49[2]:255-268.

Resnick, Rheta

1980 Subsistence Patterns at VEN-11, A Coastal Chumash Village. Master's thesis, Department of Anthropology, California State University, Northridge.

Romani, Gwen

1980 Notes on the Debris/Overburden Operations at VEN-110, Calleguas Creek, Ventura County. On file, Ventura County Flood Control District, Ventura.

Simons, Dwight D.

- 1979 Appendix B - The Vertebrate Fauna from Ventura-100: Reptiles, Birds, and Mammals. In The Archaeology of Ven-100, by James West, pp. 49-57. California Archaeological Reports 17. Resource Preservation and Interpretation Division, Cultural Heritage Section, Sacramento.

Singer, Clay, and Gwen Romani

- 1980a Systematic Archaeological Testing at Revolon Slough (CA-VEN-110), Ventura County, California. EIR (VS-80) on file, Northridge Archaeological Research Center, California State University, Northridge.

- 1980b Archaeological Testing at CA-VEN-110, Calleguas Creek, Ventura County, California. EIR (VS-80) on file, Northridge Archaeological Research Center, California State University, Northridge.

Steffen, Lyle J.

- 1982 Mugu Lagoon and its Tributaries: Geology and Sedimentation. Report on file, U. S. Department of Agriculture, Soil Conservation Service, Watershed Planning Staff, Davis.

University of California, Los Angeles, and San Fernando Valley College Field Classes

- n.d. Field Records on Simo'mo, 1959. Notes on file, Los Angeles County Museum of Natural History.

Van Bergen, C.

- n.d. Excavations at Point Mugu. Ms. (1932) on file, Los Angeles County Museum of Natural History.

Van Valkenburgh, Richard

n.d. Field Notes on the Excavations at Simo'mo in 1932. On file, Los Angeles County Museum of Natural History.

Ventura County Flood Control District, Calleguas Soil Conservation District

1963 Watershed Work Plan, Revolon Watershed, Ventura County, California. Unpublished report on file, U.S. Department of Agriculture, Soil Conservation Service, Davis.

Wallace, William

1955 A Suggested Chronology for Southern California Coastal Archaeology. Southwestern Journal of Anthropology 11[3]:214-230.

Walters, P.

1929 Chumash Village Site Excavated. El Palacio 27[19-20]: 224-226.

Warne, John E.

1966 Paleoecological Aspects of the Recent Ecology of Mugu Lagoon, California. Unpublished Ph.D dissertation, Department of Geology, University of California, Los Angeles.

1971 Paleoecological Aspects of a Modern Coastal Lagoon. University of California, Berkeley.

Warren, Claude N.

1968 Cultural Tradition and Ecological Adaptation on the Southern California Coast. In Archaic Prehistory in the Western United States, edited by C. Irwin-Williams, pp. 1-14. Eastern New Mexico Contributions in Anthropology 1[3].

Weide, David

- 1965 Some Additional Notes Made by D. L. Weide, Department of Geology, University of California, Los Angeles. On file, Los Angeles County Museum of Natural History.

Woodward, Arthur

- 1929 Shell Fish Hooks of the Chumash. Southern California Academy of Sciences Bulletin 28(41-46).

- 1930 Shells Used by the Indians of Muwu. Southern California Academy of Sciences Bulletin 29(105-114).

- n.d.a Species of Shell from Mugu. Ms. on file, Los Angeles County Museum of Natural History.

- n.d.b Unpublished Notes of Woodward-Van Bergen Excavations. Ms. on file, Los Angeles County Museum of Natural History.

#### Maps

- 1861 Rancho Guadaldasca, Ventura County, California.
- 1861 Plat of Rancho Guadaldasca. J. E. Terrell. Surveyed under instructions from the U.S. Surveyor General.
- 1874 Map of Rancho Guadaldasca as Partitioned by Order of District Court, First Judicial District, September 1874.
- ca 1900 Topographic Map of the Oxnard Plain, Ventura County, Calif. USGS ?
- 1915 Map of the Lewis Rancho, being the North One Third of Rancho Guadaldasca, Ventura County, Cal.

- 1919 Map of Part of Ranchos Guadaluasca, Colonia, and Conejo known as Broome Estate Ranch. Charles W. Petit.
- 1919 Topographical Map of a Part of Rancho Guadaluasca. Surveyed April, May 1919.
- 1928 Copy of blueprint furnished by Charles Blackstock.
- n.d. Plate 1, General Topographic Features in the Vicinity of the Eastern Arm of Mugu Lagoon, Ventura County, California.

Individuals Cited

Aiello, Paul. Instructor of Anthropology-Archaeology, Ventura College.

Browne, Robert O. Oak View, California.

Rozaire, Charles. Curator of Archaeology, Los Angeles County Museum of Natural History.

Steffen, Lyle. Watershed Geologist, U.S. Department of Agriculture, Soil Conservation Service, Davis.

Toren, A. George. Formerly, California State University, Northridge.

Warne, John E. Geologist, Colorado School of Mines, Golden.

## ARCHAEOLOGICAL FIELD CATALOG

Page No. 1 of 1

Accession No VS-80

Collector: G. Romani

**Site:** CA-VEN-110

Date 3/16/80

Date Cataloged: 4/2/80

[illegible]

# Description of Materials from CA-VEN-110

## Artifacts

Bowls (burned, unburned, whole, and fragments)  
 Beads (*Olivella* tip ends, lipped and other types; steatite tubes; small *Mytilus* disk; small *Tivela* disk)  
 Projectile points (black chert, fused shale; 1 small leaf with convex base)  
 Bone fish hook  
 Basket hopper mortars  
 Flint drill  
 Flakes (fused shale and cherty siltstone)  
 Quartz crystal  
 Possible hematite  
 Bone awl  
 Pestles  
 Manos  
 Shellfish anvil ("dimple stone")  
 Tarring pebble  
 Comal fragment, soapstone  
 Core tool

## Ecofacts

*Chione californiensis*  
*Argopecten aequisulcatus*  
*Tivela stultorum*  
*Mytilus* sp.  
*Saxidomus nuttalli*  
*Haliotis cracherodii*  
*Polinices lewisii*  
*Ostrea lurida*  
*Protothaca staminea*  
*Tagelus californianus*  
 Unidentified cockle  
 Large and small terrestrial mammals (some sheep and cow)  
 Sea mammal (e.g., *Zalophus* sp.)  
 Fish  
 Shark

## Features

Cemetery (7 burials)  
 Rock and shell concentrations, burned and unburned  
 Possible hearths  
 Two midden components in cemetery area  
 Areas of burned earth  
 Midden pockets and caps heavily embedded with shell  
 Fire fractured rocks

Compiled from 1959, 1976, 1980a/b projects

APPENDIX 2  
Present Day Botany of Simo'mo

<u>Common Name</u>	<u>Scientific Name</u>
* Burro Fat (Bladderpod)	<u>Isomeris arborea</u> Nutt.
Buckwheat	<u>Eriogonum latifolium</u> Sm.
Indian Pinks	<u>Silene laciniata</u> Cav.
' Purple Sage	<u>Salvia leucophylla</u> Greene
Yellow Mustard	<u>Brassica adpressa</u> <u>boiss</u>
Mariposa Lily	<u>Calochortus</u> sp.
* Soap Plant	<u>Chlorogalum pomeridianum</u>
Common Thistle	<u>Cirsium californicum</u> Gray
California Everlasting	<u>Gnaphalium decurrens</u> var. <u>californicum</u> Gray.
Blue Vervain	<u>Verbena hastata</u> L.
* Common Peppergrass	<u>Lepidium nitidum</u> Nutt.
Buckwheat	<u>Eriogonum elongatum</u> Beuth.
' Common Horehound	<u>Marrubium vulgare</u> L.
* Brodiaea	Sp. (?)
Rattlesnake weed	<u>Daucus pusillus</u> Michx.
Sea Blite	<u>Suaeda californica</u> Wats.
* Common Nettle	<u>Urtica gracilis</u> var. <u>holosericea</u> Jepson
' Napa Thistle	<u>Centaurea melitensis</u> L.
' Spiny Clotbur	<u>Xanthium spinosum</u> L.
Farweed	<u>Hemizonia fasciculata</u> To G.
' Mediterranean Canary-grass	<u>Phalaris</u> Ritz.
' Soft Cheat	<u>Bromus hordeaceus</u> L.
Ripgut Grass	<u>Bromus rigidus</u> Roth.
Squirrel Tail	<u>Hordeum jubatum</u> L.
Wood Sorrel	<u>Oxalis wrightii</u> Gray.
' Sowbane	<u>Chenopodium murale</u> L.
' Australian Saltbrush	<u>Atriplex semibaccata</u> R. Br.
* Opuntia- Prickly pear	<u>Opuntia</u>
' Curly Dock	<u>Rumex crispus</u> L.
Western Ragweed	<u>Ambrosia psilostachya</u> DC.



APPENDIX 2 (continued)  
Present Day Botany of Simo'mo

<u>Common Name</u>	<u>Scientific Name</u>
' Sow Thistle	<u>Sonchus tenerrimus</u> L.
' Yellow Melilot	<u>Melilotus indica</u> ALL.
Cheese-weed	<u>Mallow</u> sp. (?)
Wishbone Bush	<u>Mirabilis laevis</u> (Benth) Curran.
Common Yarrow or Milfoil	<u>Achillea millefolium</u> var. <u>lanulosa</u> Piper
* Sacapellote	<u>Perezia microcephala</u> (DC) Gray
Bindweed	<u>Convolvulus accidentalis</u> Gray
* Blue Elderberry	<u>Sambucus glauca</u> Nutt.
' Tree Tobacco	<u>Nicotiana glauca</u> Graham.
Alkali Weed	<u>Cressa cretica</u> L.
* Alkali Heath (Yerba Buena)	<u>Frankenia grandifolia</u> C.&S.
Sand Spurrey	<u>Spergularia salina</u> J&C <u>Encelia californica</u> Nutt. <u>Eigeron foliosus</u> Nutt.
' Poor Man's Wearher Glass	<u>Anagallis arvensis</u> L. <u>Grindelia camponum</u> Greene'
* Giant Rye-Grass	<u>Elymus condensatus</u> Presl.
' Ripgut Grass	<u>Bromus rigidus</u> var. <u>gussonei</u> Parl. Coss. & Der.
Koeler's Grass	<u>Koeleria cristata</u> (L) Greene
Salt Grass	<u>Distichlis spicata</u> (L) Green
* Spiny Rush	<u>Juncus acutus</u> L.
' Barley	<u>Hordeum vulgare</u> L.
* Jimson Weed	<u>Datura metaloides</u>
* Used by other California tribes.	
' Not native to this locale--exotic.	

(Van Bergen 1932)

APPENDIX 3  
Sea Mammals from Muwu and Simo'mo

	<u>Muwu</u>	<u>Simo'mo</u>
California sea lion - <u>Zalophus californianus</u>	x	x
Sea otter - <u>Enhydra lutris</u>	x	x
Harbor seal - <u>Phoca vitulina</u>	x	x
Stellar sea lion - <u>Eumetopias jubata</u>	x	
Pribilof fur seal - <u>Callorhinus alascanus</u>	x	
Guadalupe fur seal - <u>Arctocephalus townsendi</u>	x	
Northern elephant seal - <u>Mirounga angustirostris</u>	x	
Whales - Cetacea	x	
Porpoises - Phocoenidae		x
Dolphins - Delphinidae		x

x = present

(Los Angeles County Museum Field Party n.d.; Resnick 1980:123, Table 16)

# APPENDIX 4

## Birds from Muwu and Simo'mo

<u>Species</u>	<u>Muwu</u>	<u>Simo'mo</u>
<u>Phalacrocorax penicillatus</u>	x	x
(Brandt cormorant)	x	x
<u>Phalacrocorax auritus</u>		
(Farrallon cormorant)	x	x
<u>Phalacrocorax pelagicus</u>		
(Baird cormorant)	x	
<u>Phalacrocorax sp.</u>		
(cormorant)	x	x
<u>Diomedea sp.</u>		
(albatross)	x	?
<u>Larus occidentalis</u>		
(western gull)	x	
<u>Ardea herodias</u>		
(great blue heron)	x	
<u>Gavia immer</u>		
(common loon)	x	
<u>Gavia arctica</u>		
(Pacific loon)	x	x
<u>Gavia stellata</u>		
(red-throated loon)	x	
<u>Gavia sp.</u>		
(loon)	x	x
<u>Cathartes aura</u>		
(turkey vulture)	x	
<u>Buteo jamaicensis</u>		
(red-tailed hawk)	x	x
<u>Pelecanus occidentalis</u>		
(brown pelican)	x	x

# APPENDIX 4 (continued)

## Birds from Muwu and Simo'mo

<u>Species</u>	<u>Muwu</u>	<u>Simo'mo</u>
<u>Casmerodius albus</u> (common egret)	x	
<u>Grus canadensis</u> (sandhill crane)	x	
<u>Falco mexicanus</u> (prairie falcon)	x	
<u>Branta</u> sp. (goose)	x	x
<u>Anas</u> sp. (duck)	x	x
<u>Corvus</u> sp. (raven)		x
<u>Uria aalge</u> (California murre)		x
<u>Aechmophorus occidentalis</u> (Western grebe)		x
<u>Podiceps caspicus</u> (Eared grebe?)		x
<u>Numenius phaeopus</u> (Hudsonian curlew)		x

x = present

(Los Angeles County Musuem Field Party n.d.; Resnick 1980: 122, Table 15)

## APPENDIX 5

### Fish Remains from Muwu

Myliobatis californica  
Rhinobatos productus  
Urolophus halleri  
Cynoscion nobilis  
Paralichthys californicus  
Squatina californica  
Damalichthys vacca  
Sarda chiliensis  
Genyonemus lineatus  
Seriphus politus  
Oxyjulis californica  
Sebastes serranoides  
Rhacochilus toxotes  
Sebastes atrovirens  
Anisotremus davidsonii  
Scorpaena guttata  
Pimelometopon pulchrum  
Pneumatophorus japonicus  
Sphyræna argentea  
Isurus oxyrinchus  
Xiphias gladius  
Tetrapturus audax  
Galeocerdo cuvier  
Myliobatis californicus  
Seriola dorsalis  
Sarda lineolata  
Carcharodon carcharias  
Sebastes paucispinis

Bat ray\*  
 Shovelnose guitarfish\*  
 Round stingray\*  
 White seabass\*  
 California halibut\*  
 Pacific angel shark\*  
 Pile perch\*  
 Pacific bonito\*  
 White croaker\*  
 Queenfish\*  
 Senorita\*  
 Olive rockfish\*  
 Rubberlip surfperch  
 Kelp rockfish  
 Sargo  
 Sculpin  
 California sheephead  
 Pacific mackerel  
 Pacific barracuda  
 Bonito shark  
 Broadbill swordfish  
 Striped marlin  
 Tiger shark  
 California stingray  
 Yellowtail  
 California bonito  
 Great white shark  
 Rock cod

\* = lagoon dwelling fish

(Resnick 1980:Tables 10, 13, 14)

Note: The taxonomy has been considerably revised since Follett's report.

## APPENDIX 6

### Shellfish Species Found in Mugu Lagoon

#### GASTROPODA

Acmaea depicta

Acmaea sp.\*

Acteon punctocaelatus

Acteocina culcitella

Bulla gouldiana

Cerithidea californica

Conus californicus

Crepidula lingulata\*

Crepidula nummaria

Crepidula onyx

Epitonium cooperi

Haliotis sp.\*

Haminoea vesicula

Haminoea virescens

Jaton festivus

Lacuna unifasciata

Limnaea sp.

Littorina sp.

Lunatia lewisi

Margarites parcipictus

Melampus olivaceus

Mitrella carinata

Olivella biplicata \*

Olivella diegoensis

Nassarius tegula

Polinices reclusianus?

Pyramidella sp.

Rissoina sp.

Tricolia compta

Nassarius fossatus?

Nassarius mendicus?

Nassarius perpinquis?

#### PELECYPODA

Chione californiensis\*

Chione fluctifraga\*

Chione undatella

Clinocardium nuttallii

Cooperella subdiaphana

Cryptomya californica

Cumingia californica

Diplodonta orbella

Donax californica

Donax gouldii

Heterdonax bimaculata

Laevicardium substriatum\*

Leptopecten latiauratus

Lucinisca nuttallii

Nuculana sp.

Ostrea lurida\*

Parvilucina sp.

Pecten circularis

Petricola sp.

Protothaca staminea\*

Psammotreta biangulata

Rochefortia sp.

Sanguinolaria nuttallii

Saxidomus nuttallii\*

Semele incongrua

Spisula dolabriformis

Tagelus californianus\*

Tellina carpenteri

APPENDIX 6 (continued)

Shellfish Species Found in Mugu Lagoon

PELECYPODA

Lyonsia californica

Macoma irus?

Macoma nasuta?

Macoma secta?

Mactra californica

Mytilus edulis?

Tellina idae\*

Tellina modesta

Thracia sp.

Tivela stultorum\*

Tresus nuttallii\*

Zirfaea pilsbryi

(Warne 1971; Resnick 1980: Table 1, Figure 15)

\* = Found at CA-VEN-11

? = Only genus identified at CA-VEN-11

END

12-86

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